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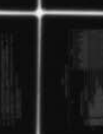
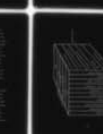
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A COMPARISON OF SQUADRON LEVEL  
PERFORMANCE AND RESPONSIBILITY CENTER  
MANAGER INVOLVEMENT IN  
RESOURCE MANAGEMENT

Roger C. Bradley, Major, USAF  
Thomas C. McSwain, Jr., Captain, USAF

LSSR 3-77A

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER <b>AF711-LSSR-3-77A</b>	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) <b>A COMPARISON OF SQUADRON LEVEL PERFORMANCE AND RESPONSIBILITY CENTER MANAGER INVOLVEMENT IN RESOURCE MANAGEMENT</b>	5. TYPE OF REPORT & PERIOD COVERED <b>Master's Thesis</b>	
7. AUTHOR(s) <b>Roger C. Bradley Major, USAF Thomas C. McSwain, Jr. Captain, USAF</b>	8. CONTRACT OR GRANT NUMBER(s)	
9. PERFORMING ORGANIZATION NAME AND ADDRESS <b>Graduate Education Division School of Systems and Logistics Air Force Institute of Technology, WPAFB, OH</b>	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS	
11. CONTROLLING OFFICE NAME AND ADDRESS <b>Department of Research and Administrative Management (LSGR) AFIT/LSGR, WPAFB, OH 45433</b>	12. REPORT DATE <b>June 1977</b>	
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) <b>12 191 p.</b>	13. NUMBER OF PAGES <b>176</b>	
	15. SECURITY CLASS. (of this report) <b>UNCLASSIFIED</b>	
15a. DECLASSIFICATION/DOWNGRADING SCHEDULE		
16. DISTRIBUTION STATEMENT (of this Report)  <b>Approved for public release; distribution unlimited</b>		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES  <b>APPROVED FOR PUBLIC RELEASE AFR 190-17. JERRAL F. GUESS, CAPT, USAF Director of Information</b>		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number)  <b>Resource Management Systems Financial Management Organizational Efficiency and Effectiveness</b>		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number)  <b>Thesis Chairman: Darrell N. Fulton, Captain, USAF</b>		

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The purpose of this research was to determine the degree of USAF squadron level Responsibility Center Manager (RCM) involvement in the base level Resource Management Systems (RMS) and to test the relationship of this involvement with organizational efficiency and effectiveness. A survey instrument was administered to a random sample of RCMs in selected major commands. Using factor analysis, five factors were identified which characterized RCM involvement in the RMS. Those five factors were described as: Review and Monitoring Resource Consumption; Use of the Resource Advisor; Control of Resources; Interface with the Commander and Financial Management Committees; and Interface with Subordinate Cost Centers. RCM involvement in Review and Monitoring Resource Consumption, Use of the Resource Advisor, and Interface with Subordinate Cost Centers was found to be relatively high. There was an indication of involvement in the remaining factors, however, the level of involvement could not be characterized as either high or low. There was no meaningful positive correlation between the level of involvement in the five factors and organizational efficiency or effectiveness as had been hypothesized. This provided an indication that the DOD RMS are not achieving their goal of helping managers operate efficiently and effectively.

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A COMPARISON OF SQUADRON LEVEL PERFORMANCE AND  
RESPONSIBILITY CENTER MANAGER INVOLVEMENT  
IN RESOURCE MANAGEMENT

A Thesis

Presented to the Faculty of the School of Systems and Logistics  
of the Air Force Institute of Technology

Air University

In Partial Fulfillment of the Requirements for the  
Degree of Master of Science in Logistics Management

By

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June 1977

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This thesis, written by

Major Roger C. Bradley

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has been accepted by the undersigned on behalf of the faculty of the School of Systems and Logistics in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE IN LOGISTICS MANAGEMENT

DATE: 15 June 1977

*Danell N. Fulton*

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#### ACKNOWLEDGEMENTS

This research project would not have been possible without the comprehensive financial management expertise and understanding of our thesis chairman, Captain Darrell N. Fulton. Not only his capability but his eagerness and willingness to guide and support our efforts will long be remembered and appreciated. In addition, the suggestions and professionalism of our typist, Linda Pearson, and the patience, encouragement, and understanding of our wives, Lynne and Jane, will also be remembered for their immeasurable contribution to this project. To Darrell, Linda, Lynne and Jane, we express our most sincere and warmest appreciation.

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## CHAPTER I

### INTRODUCTION

#### Overview

The general purpose of this research was to look at resource management procedures at the squadron level with the ultimate objective of helping the Air Force conserve resources. This chapter is devoted to a discussion of the importance of financial management, a brief description of the DOD Resource Management System (RMS), a statement of the specific problem to be addressed by this research, the importance of the problem, a statement of the research objectives, the research question to be answered, and the research hypotheses to be tested.

#### Importance of Financial Management

On May 24, 1966, then President Lyndon B. Johnson emphasized the problem facing managers in the federal government:

I want every manager to think of his part of the total Government in terms of everything he owns, everything he owes and the full cost of doing every job in relation to the product resulting from these costs. I want him to think of minimal costs and cost reduction as profit and I want him to think in terms of his profit as a result of how he uses all the resources entrusted to him. These goals cannot



be fully achieved without sound financial management practices [46:Frontispiece].

Today, as in 1966, sound financial management is absolutely critical to all agencies of the federal government, and in particular to the Department of Defense (DOD) and the United States Air Force (USAF). In this regard, the former Commander of Tactical Air Command, General Momyer, stated that:

. . . actual and forecast reductions in the defense budget emphasize the need for each commander to give precedence to not only the conservation of dollar expenditures but of equal importance the essentiality of every dollar that is spent [25:back-page].

More recently, the Air Force Chief of Staff, General Jones highlighted the need for improved resource management within the USAF by stating that:

The Secretary of Defense has given the Services good incentives. He said that if we find some savings in our Services we could convert them into mission capability. All the Services are working on this. The Army is going from 13 to 16 divisions; we in the Air Force are going from 22 to 26 Tactical Fighter Wings. We are doing it out of our own hide--that's the result of a good incentive. We, in turn, have to provide incentives to the people and units we manage. . . . The man that manages well this year too often gets less money next year. In such a case, there is no reward for good management. So we need to look at basic procedures down at the local level to find ways to provide better incentives [17:7].

#### The Resource Management Systems in Brief

To enhance sound financial management, DOD established the Resource Management Systems (RMS) at

the operating level on 1 July 1968 (7:1). The systems were originally defined in DOD Directive 7000.1 to:

Include all procedures for collecting and processing recurring quantitative information that (1) relates to resources and (2) is for the use of management [47:1].

The Air Force definition, however, is somewhat broader and states that:

Resources are . . . men, materials, and services. Taken separately, there are numerous programs and systems for managing each. There are many times, however, when resources must be managed as a whole . . . . RMS, then, is all the individual resource management programs and systems pulled together [37:2].

A key premise of the RMS in the USAF is that "primary control over the consumption of resources is exercised through the managers of base organizations [43:2-7]." Equally important is the concept that just as "management within the Air Force operates through the chain of command . . . Financial management operates through the same structure [43:2-14]."

The structural arrangement of the Air Force organization utilizes two basic types of managers: the line manager and the staff manager.

Line managers plan and direct the actions of an organization or program in terms of an all inclusive budget, and then manage the program within the resources allocated [43:3-1].

Line Management possesses the *authority* to act. Staff management, on the other hand, "cuts across organizational lines [43:3-1]." They are specialists in relating

available resources to required programs and their function is to assist and advise line managers. "Their role is to support line managers, not make decisions for them [43:3-1]."

Because resource management operates through the chain of command, the hierarchy of base organization managers must be defined in RMS terms. At the top of the *normal* base structure is the wing/center commander. USAF designates this position as responsibility center (RC) level one (37:5). AFM 178-6 states that "financial management is a function of command [43:3-1]" and that a commander's attention to the review of budgeting and financial progress is considered ". . . critical to the success of the financial management process [43:3-1]."

Directly beneath the commander and again related to the organizational structure, resource management is vertically stratified into additional responsibility center levels. RC level two, herein referred to as the deputate level RC, contains line managers, such as the Deputy Commander for Operations, Combat Support Group Commander, Hospital Commander, etc. (43:307). The next level, RC level 3, is subordinate to the deputate level RC and is referred to as the squadron level RC. The incumbent of a position at this level is also a line manager, the squadron commander or division chief (43:2-7).

To help each level RCM fulfill his responsibilities in resource management, a staff position, the resource advisor (RA) has been created. The appointment of an RA within each RC is directed by AFM 178-6. The charter of this individual is:

. . . to monitor the preparation of estimated requirements for resources, participate in the development of expense targets, and monitor the utilization of resources in day-to-day operations [43:3-2].

The lowest level of the base organizational structure, the branch level, also relates directly to the RC structure. This level is subordinate to the squadron level RC and is referred to as the cost center level (43:2-7). The cost center is the section/shop level of the organizational chain or "the unit level where actual consumption of resources takes place [43:2-9]." The cost center manager is the individual who regulates the proper mix of resource consumption for production accomplishment (43:3-2). Because of his awareness of day-to-day relationships between consumption and production, the cost center manager is considered "the base, or point of initial action in the building block process of operating budget development [43:3-2]." It is his assessment and justification of resource requirements that determines:

The validity of the wing or center operating budget as a whole . . . . It is essential to the success of the [RMS] process that the managers be

included in, and expected to perform, a positive and active role on the RC resource management team [43:3-2].

#### Statement of the Problem

The basic philosophy with respect to base level financial management is that involvement in the RMS by the squadron level RCMs most directly associated with the base mission ". . . largely and ultimately determine the effectiveness with which resources are used [43:3-1].". Conversely, a lack of involvement by squadron level RCMs could lead to ineffective resource management at base level (37:15,21). Recent observations by resource management experts indicate that squadron level RCMs may not always be involved in resource management (8; 19). The implication of the above observations is that a need exists to determine: (1) the extent of squadron level RCM involvement in RMS, and (2) the relationship between squadron level RCM involvement in RMS and the squadron's efficiency and effectiveness.

#### Importance of the Problem

As related in an earlier section of this chapter, Presidential and General Officer statements reflected the importance of effective resource management down to base level in the USAF. Secondly, a recent draft HQ USAF publication stated that ". . . there is a continuing need

to improve the quality and quantity of resource management throughout the Air Force [44:1]."

Further, the Air Force Chief of Staff, General Jones, indicated that the RMS was not functioning as well as it could when he stated that: "I think the opportunities to operate within our budget more efficiently and to get a lot more out of our allocations are almost unlimited [17:7]."

This need was further amplified by the establishment of HQ USAF, MAJCOM, and base level Resource Management Teams (RMTs) in January 1976 (43:4-1). The purpose of these teams is to train Air Force managers in proper management of resources and to obtain new resource management ideas from one organization and pass those ideas to other organizations (43:4-1; 4). Reports from the HQ USAF RMT visits detailing positive and negative aspects of base level resource management are furnished to the Air Force Chief of Staff and to MAJCOM Commanders (44:3). The creation of these teams as well as the high level distribution of reports indicates that the RMS at base level is not functioning as well as it could (4).

More specific justification for this research effort was found in the literature on RMS. Dr. Robert E. Boynton in reporting his research on the RMS concluded that:



Since the documents which record the results of the system seem generally adequate, emphasis should now shift to the improvement of the information, participation, and delegation processes by which the management systems are made effective tools of the manager [5:37].

Additional information indicated that the delegation processes are not necessarily working as they might. Telephone interviews with members of the HQ USAF Systems and Resource Management Action Group (SRMAG) rendered conclusions about the RMS at base level which were not documented in the SRMAG report. Based on observations at approximately forty Air Force bases, the SRMAG members concluded that the squadron level RCMs were sometimes being bypassed in the base level management of resources (8; 19). They further indicated that the RA, the staff element in the RC, was being expected to manage resources and make resource allocation and budgeting decisions while squadron level RCMs managed organizational production, with very little coordination and interface between the two individuals. Situations were also observed where the base budget officer rather than the appropriate squadron level RCM was directing the RA's resource management efforts (8; 19).

Thus, if the RMS is to work effectively, it must include full participation by the squadron level RCM. The RMS at base level is designed to include the

squadron level RC line manager as the primary manager of resources (37:29)

RCs are designated down to the third (squadron) level because that's where most of our big dollars are spent when we look at base level organizational entities--and that is where we need to focus our attention [37:29].

#### Research Objectives

The objectives of this research were:

1. To determine the extent of squadron level RC involvement in the base resource management systems.
2. To determine if squadron level RCM involvement in resource management is related to squadron level effectiveness.
3. To determine if squadron level RCM involvement in resource management is related to squadron level efficiency.

#### The Research Question

To what extent is the squadron level responsibility center manager involved in the base resource management systems?

#### The Research Hypotheses

1. Squadron level responsibility center manager involvement in resource management is directly related to squadron level effectiveness.



2. Squadron level responsibility center manager involvement in resource management is directly related to squadron level efficiency.

## CHAPTER II

### RESOURCE MANAGEMENT SYSTEMS CONCEPTS

This chapter provides an overview of the DOD Resource Management Systems (RMS). The chapter contains detailed and frequent concentration on the systems above base level. This emphasis is to assist the reader who may be familiar with management concepts but who is unfamiliar with the DOD RMS and to enable him to understand how base level resource management integrates with and affects total Air Force resource management. In addition, this chapter develops the background necessary to conduct this research effort.

This chapter discusses the historical events leading to implementation of the RMS in DOD, provides a description of the RMS, and explains how base level resource management is accomplished within the RMS.

#### Historical Events Leading to Implementation of the RMS

The Resource Management Systems (RMS) were initially developed to correct deficiencies that evolved in the DOD process of obtaining and managing resources (24:69-70). Prior to implementation of the RMS, all military department budgets were being channeled through

DOD to the Executive Department (12:23). As the military department budgets increased coincidentally to the Sputnik scare, the Bureau of the Budget began to give DOD a "budget ceiling" for the combined DOD budget (46:21). This forced the Secretary of Defense to combine the departments' submissions and often cut these submissions in order to get under the "budget ceiling."

The "budget ceiling" concept became an integral part of the DOD process in the 1950s and led to many significant problems in DOD budgeting. In order to increase its share of the budget, each Service was motivated to overemphasize its own priorities and missions and to protect the size of its own forces, even to the detriment of readiness (28:81-110). In addition, since the DOD budget was only for each succeeding year, the services were motivated to propose many new programs for the budget year so that they could receive a larger share of the budget allocation in follow-on years (15:24-26). The resulting interservice rivalry caused the Secretary of Defense to become very involved in budgeting in order to insure that national defense could be provided within the "budget ceiling."

A new problem however began to materialize. Budgeting was being accomplished on a single year basis, whereas planning of forces was being conducted by the individual Services for a period of four years or

longer (21:3). The result was ". . . almost complete separation between budgeting and military planning [21:4]." In addition, budgeting faced the hard cold realities of dollar limitations but military planning was conducted in ". . . absolute terms without reference to costs [46:22]." Planning, on the one hand, was in terms of missions, weapon systems, and forces and extended several years into the future (15:25-6). Budgeting, on the other hand, was in terms of appropriation categories such as personnel, procurement and military construction, and extended only one year in the future. In short, planning and budgeting were not integrated on any formal basis (15:25-6; 30:26).

As a result of this situation, President Kennedy gave Secretary of Defense McNamara two broad instructions: (1) "Develop the military force structure necessary to support foreign policy without regard to arbitrary budget ceilings;" and (2) "Procure and operate this force at the lowest possible cost [21:3]."

Secretary McNamara summarized the situation by saying:

From the beginning the principal problem in efficient management of DOD's resources was not the lack of management authority . . . . The problem rather was the absence of the essential management tools needed to make sound decisions . . . . What we needed was coordinated strategy, seeking objectives actually obtainable with the military resources available. In the past so-called requirements bore almost no relation to the real world. A new form

of budget for the first time grouped together for planning purposes, units that must fight together in the event of war . . . . One of the first things we did in 1961 was to design a new mechanism which could provide this information and integrate it into a single coherent management system [24:69-70].

Thus, the idea for the Resource Management System was born.

#### Description of the RMS

##### Objectives of RMS

Dr. Robert Anthony, Assistant Secretary of Defense (Comptroller) under McNamara, was one of the primary architects of the RMS. His text, *Management Accounting Principles*, yields much insight into the concepts he applied while developing the RMS. In the text, Dr. Anthony defined management control as ". . . the process by which managers assure that resources are obtained and used effectively and efficiently in the accomplishment of an organization's objectives [1:306]." (Italics supplied) He further stated that "with rare exceptions a management control system is built around a financial structure . . . [1:307]."

The wording in DOD Directive 7000.1 is very similar to the wording in Dr. Anthony's text. One objective of RMS stated in the directive is:

To provide managers at all levels within the Department of Defense with information that will help them assure that resources are obtained and

*used effectively and efficiently* in the accomplishment of Department of Defense objectives [47:2-3]. (Italics supplied)

#### Efficiency and Effectiveness

The performance of the Responsibility Center as used in the RMS objective was viewed in terms similar to the Model for Mission Accomplishment in Figure 1. Inputs in the form of resources are processed to provide outputs. Outputs could be national defense, launching aircraft, or any task at any level within the DOD. Effectiveness relates to the production of outputs and can be measured in terms of quantity (e.g., aircraft launched or number of meals served) or quality (e.g., rating given during Operational Readiness Inspections) (13). Efficiency, on the other hand, is a measure of the relationship between inputs and outputs (e.g., inputs÷outputs or cost per unit produced) (13). The responsibility center's performance could then be evaluated in terms of effectiveness and efficiency.

#### Design of the RMS

Dr. Anthony believed the objectives of efficiency and effectiveness were best realized in the management control process shown in Figure 2. From this model with its key steps of programming, budgeting, accounting, and reporting and analysis; he designed the RMS.

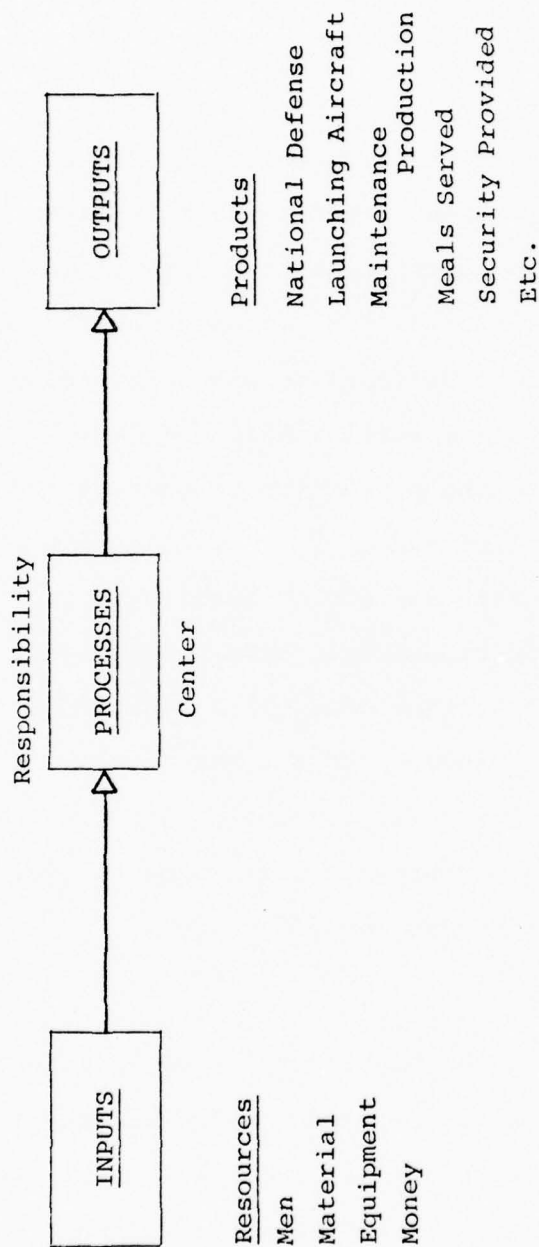


Figure 1. Model for Mission Accomplishment (13)



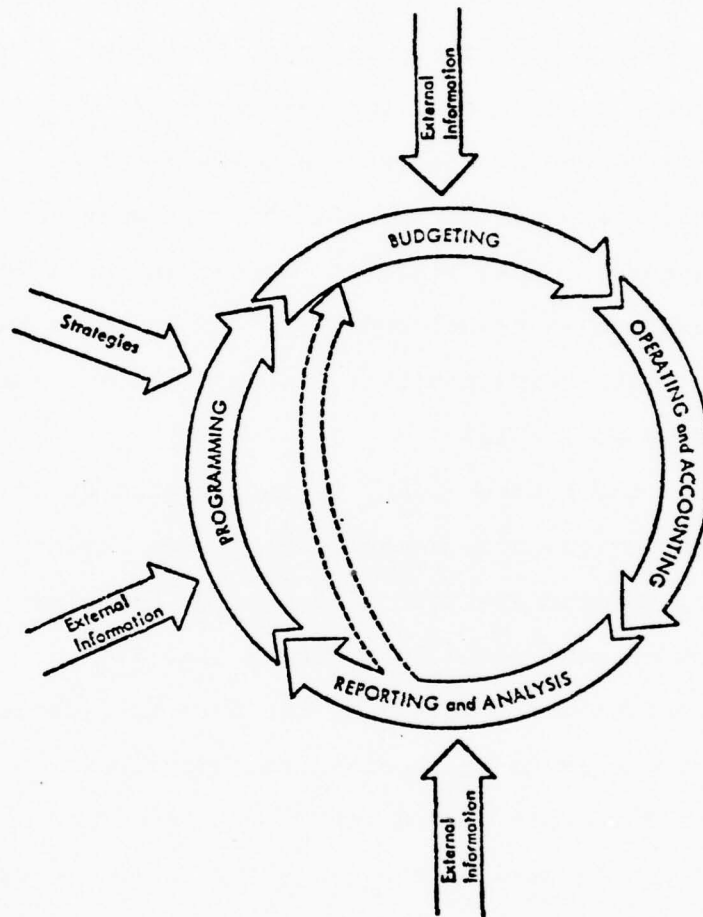


Figure 2. The Management Control Model (1:316)



During the programming phase, managers develop the major programs (considering previously determined objectives and strategies) in which their organization will participate during the subsequent period(s). The programs schedule resources (inputs) necessary to accomplish objectives and strategies. Budgets are then developed which express the plan in ". . . quantitative, usually monetary, terms [1:316]." During budget development, the program is transformed ". . . into terms that correspond to the responsibility of those who are charged with executing it [1:316]."

After the budget (plan) is implemented during an operating period, accounting takes place, during which ". . . records are kept of resources actually consumed and outputs actually achieved [1:317]."

Reporting and analysis of the data thus obtained enables information to be reported to individuals in the organization that have a need for it. In addition, this information can be used as the basis for follow-on programming and budgeting as well as for decision making and to measure the effectiveness and efficiency of individual managers (1:317-318).

#### The Five Year Defense Program

Since planning and budgeting in the DOD had not been integrated on any formal basis, DOD planners were

faced with developing and transforming Dr. Anthony's conceptual process into a structure that could provide the necessary integration. The planners developed the Five Year Defense Program (FYDP) as the integrating tool to form the ". . . nucleus of the Department of Defense resource management system [47:31]." The FYDP is a data base which integrates resources needed with the plans that estimate requirements for forces over a five-year period. The document also includes forecasted force requirements only for an additional three-year period (43:A1-2). Budget submissions are prepared annually by all levels in the DOD to coincide with the resource requirements contained in the FYDP (43:2-12). The FYDP then matches Major Force Programs to Congressional appropriations as shown in Figure 3.

#### Subsystems of RMS

Subsystems of RMS were next developed to provide the structure for accomplishing the objectives of the RMS (47:3-5). A better understanding of how the FYDP performs the integration function and of how base level responsibility centers fit into the RMS can be obtained by reviewing each of the four RMS subsystems: the Planning, Programming, and Budgeting Subsystem (PPBS); the Management of Resources for Operating Activities Subsystem (OMS); the Management of Inventories Subsystem

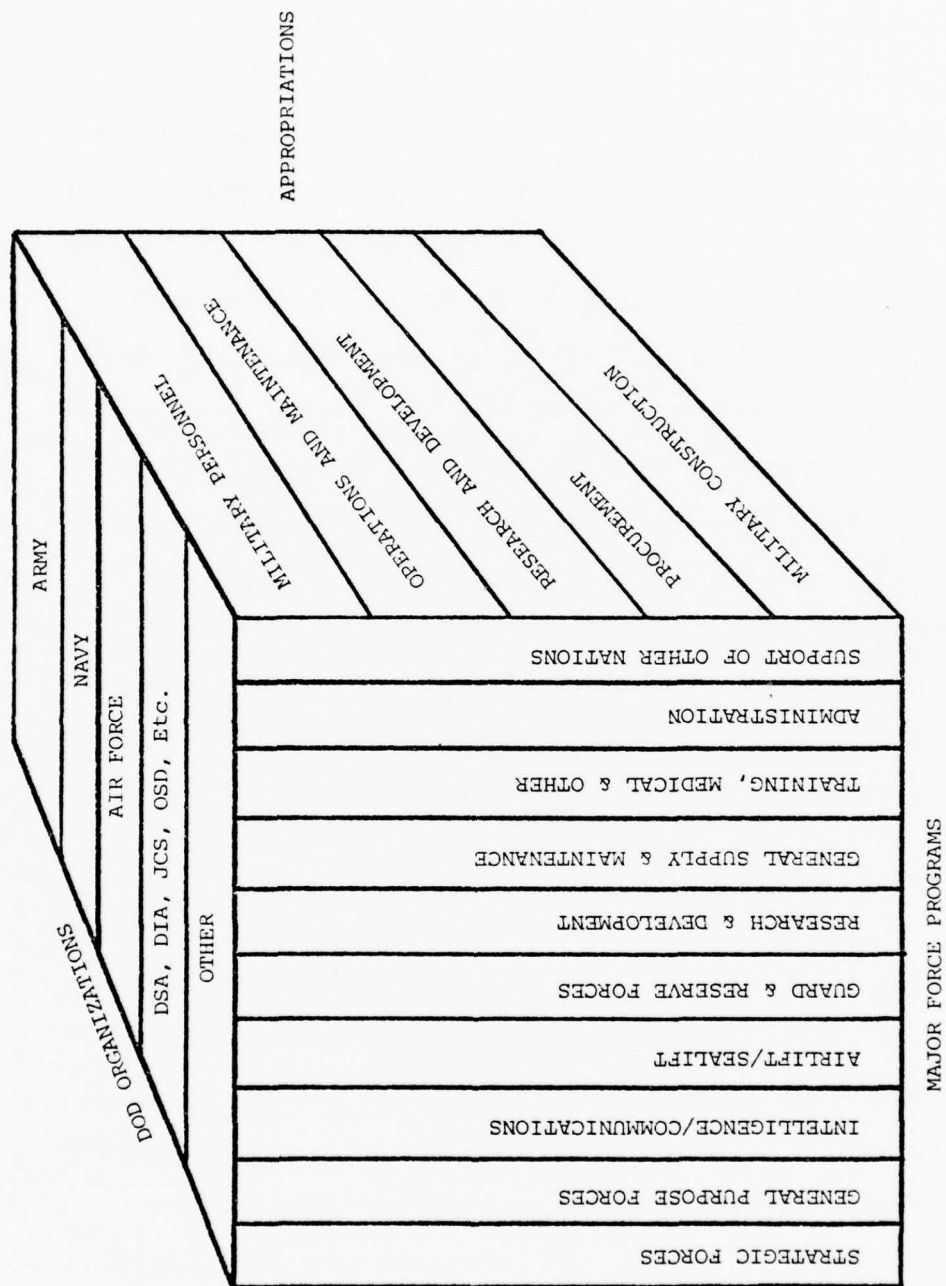


Figure 3. The Five Year Defense Program As An Integrating Tool (13)

(IMS); and the Management of Capital Acquisitions Subsystems (AIMS).

The Planning, Programming and Budgeting Subsystem (PPBS). This subsystem was designed to be primarily concerned with the programming and budgeting phases of Dr. Anthony's Management Control Model. The FYDP contains the long-range programs, and budgets are prepared annually to match dollar requirements to approved programs (13).

The objective of this subsystem as stated in DOD Directive 7000.1 are:

1. Be correlated as fully as possible . . . with management accounting systems, using common data elements and definitions, translatable structures and nonduplicative procedures and schedules.
2. Be organized so as to focus on the goals purposes and outputs of the Department of Defense and on the costs of achieving these goals [47:3].

Budget estimates in support of this subsystem are ". . . accumulated upward until a total Air Force budget is formulated (The Budget Submission) [3:13]."

The lowest level budget phase begins when the instructions for preparing the preliminary budget are forwarded from MAJCOM to the base budget officer. He distributes this "call," as it is known, to the RA in each organization who then tasks each cost center manager in the RC to prepare budget requirements for the following year. During the initial budget formulation

the RA maintains close coordination with the squadron level RCM who has overall responsibility for the budget preparation (38:9-10).

The base budget officer's role at this point is simply to interpret the call while each RA develops his organization's requirements without being tied to a firm dollar limitation. The dollar limitation soon follows the call, however, and is provided by each MAJCOM in the form of a "bogey" or estimated fund target which anticipates what the Air Force budget will be (14:127-134).

Following the receipt of the bogey, the important integration of budget requirements begins through a committee known as the Financial Working Group (FWG). Here, the resource advisors from all base RCs collectively review the tentative base budget and receive their portion of the bogey. The budget prepared by each RA is revised to be consistent with the bogey and then this refined product is forwarded for review by another committee called the Financial Management Board (FMB). Members of this board are the major organization commanders of the base--normally the Wing Commander, and deputation level RCMs. With their approval, the proposed budget is forwarded to MAJCOM (14:130-134).

It can be seen from the budget process that a key concept of PPBS is participatory financial management (3:1; 25:backpage; 38:14). Personal contacts are used

by the resource advisor in preparing the budget, followed by committee review and action in the form of the FWG (line and staff members) and the FMB (line members).

The objective is to give line managers flexibility in determining how resources are to be committed to mission accomplishments and still recognize the technical and supporting responsibilities of staff managers [38:14].

Commanders are not expected to become fiscal experts, but with the advice of their organization member who *is* an expert, the resource advisor, commanders can relate mission requirements and functional responsibilities into budget estimate terms thereby assuming a direct and active role in financial management (25:back-page).

Ultimately, the PPBS serves as the mechanism for balancing weapons, programs, force requirements, military strategy and foreign policy objectives, it serves as the basis for defense budget proposals to Congress; it provides for integrating the requirements of all services within DOD; and it results in the entire defense establishment working with a plan that is realistic, dynamic, comprehensive and, most important, financially based (24:70).

The Management of Resources for Operating Activities Subsystem (OMS). This subsystem was designed to



incorporate the accounting phase and the reporting and analysis phase of Dr. Anthony's Management Control Model. The subsystem becomes operational in the RMS cycle following release of funds by Congress and the Office of Management and Budget. At this stage, funds are actually distributed to the base level (45:34).

The objectives of this subsystem as stated in DOD Directive 7000.1 are:

1. Focus on outputs and on resources used, i.e., expenses.
2. Focus on managers who are responsible for effective and efficient utilization of resources.
3. Focus on actual performance in relation to planned performance.
4. Use expense operating budgets and accounting as a primary aid in management control at each organization level [47:3].

The RCMs, RAs, and cost center managers are the key personnel operating in this subsystem at base level for they are responsible for the operating activities which are the primary consumers of resources (37:21).

As users and consumers of resources, operating activities are concerned with the final efficient application of resources. However, the operator is most concerned with accomplishing his mission. From his nearness to the task, the operator is in a position to determine and to define accurately his resource needs. The challenge is for the operator to define his needs so that the other resource managers understand and prepare in time to provide his needs [41:2].

The consumption-oriented subsystem operates at base level through the FWG and the FMB in a similar manner to the PPBS subsystem. The FWG (consisting of RAs)



monitors actual consumption of resources by all base organizations (37:14). If an organization's actual consumption of resources deviates significantly from the planned consumption (budget), the FWG works with the organization's RA to develop financial priorities and recommend alternative courses of corrective action to the FMB (37:14). The FMB then considers the recommendations by the FWG; further reviews actual versus planned consumption of resources; and decides on the course of action that will maximize base-wide effectiveness and efficiency under existing constraints (37:14).

As in the PPBS subsystem, participatory resource management is the key element to success and is provided by interactions between resource advisors and responsibility center managers in the FWG and FMB respectively. The absence of participation by any of the key personnel could lead to inefficient and ineffective management of resources under this subsystem (43:3-3; 3:17).

The single most important consideration when developing the committees' membership is the need to insure all vested interests on base are represented and involved. If FMB and FWG membership is restricted to "selected" responsibility center managers and selected resource advisors, then the scope of the groups' efforts will be narrow [37:15].

The Management of Inventories Subsystem (IMS). This subsystem supports the accounting phase of Dr. Anthony's model (13); provides for management of inventory resources

after acquisition; and provides the resources to the responsibility center managers when needed (41:2).

DOD Directive 7000.1 includes the following objectives for this subsystem:

1. Measure available inventory in readiness terms, against approved requirements.
2. Be capable of summary aggregations to meet the needs of all management levels.
3. Maximize the capability to use common stores of inventory for all DOD purposes and consumers [47:2].

This subsystem primarily supports base level resource management through stock/industrial funds (13).

The Management of Capital Acquisitions Subsystems (AIMS). This subsystem applies all the phases of Dr. Anthony's Management Control Model to the acquisition of specific capital resources (e.g., major weapons systems) (13).

DOD Directive 7000.1 includes the following objectives for this subsystem:

1. Focus on the item (or component thereof) being acquired, its quality, its time schedule, and its cost, in terms of both plans and actuals.
2. Include special information subsystems applicable to acquisitions of selected major capital items.
3. Be standardized and controlled, to the extent practicable, so as to minimize the data gathering and reporting work load imposed on contractors and in-house activities.
4. Be structured so as to minimize changes required to accounting systems used by contractors [47:4].

Base level resource managers are seldom, if ever, involved in the application of this subsystem. This

subsystem is normally applied by organizations involved in major acquisitions, i.e., Air Force Systems Command, HQ USAF, or DOD (13).

#### How Base Level Resource Management is Accomplished

The above discussions of the RMS provide the conceptual framework within which base level managers operate. Since efficient and effective management of Air Force resource expenditures is greatly dependent on base level management, this section is devoted to a more detailed description of how base level resource management is integrated into the Air Force structure.

#### How Financial Data Reaches Top Level Managers

As has been shown, the RMS is a continuing process consisting of a Planning, Programming and Budgeting phase (PPBS) and an accounting, reporting and analysis phase designated primarily as the Management of Resources for Operating Activities Subsystem. And, as shown earlier, the FYDP serves as a skeleton to join and give support to PPBS and operations (43:A1-2). As will now be shown, there is a very straightforward support structure within the FYDP which describes categories of actual consumption and allows relation of this consumption to future and existing program requirements. This structure permits

the integration of congressional appropriation categories with mission operating categories.

Since resource consumption occurs at the base cost center, it is there that the process of describing consumption first occurs in the form of an Element of Expense/Investment Code (EEIC). Through this numerical code, the cost center managers, RCMs and RAs identify resource consumption associated with congressional appropriation subdivisions (e.g., utilities, civilian personnel, services, supplies, aviation fuel) (43:A1-5).

Expenses in each EEIC are then accumulated as they relate to a mission by another FYDP supporting structure called the Program Element (PE) (43:A1-4).

These PEs are a:

Description of the missions or programs which identify the organizational entities and the resources needed to perform an assigned mission. They also serve as a means for collecting actual costs and relating them to program costs [37:8].

An example of a PE would be B-52 squadrons (43:A1-4).

PEs are next accumulated into Major Force Programs (MFPs). These ten MFPs are as follows:

1. Strategic Forces
2. General Purpose Forces
3. Intelligence and Communications
4. Airlift and Sealift
5. Guard and Reserve Forces
6. Research and Development
7. Central Supply and Maintenance
8. Training, Medical and Other General Personnel Activities
9. Administrative and Associated Activities
10. Support of Other Nations [43:A1-5].

Continuing the example, B-52 information would be accumulated into the Strategic Forces MFP. Thus, consumption which occurs at the base cost center is reported in terms of appropriations and missions and is integrated by the FYDP as previously shown in Figure 3.

#### Responsibilities of Base Level Resource Managers

Because consumption of resources in base cost centers is dynamic, key individuals are required to monitor and control resources as appropriations are transformed into mission accomplishments. Following are the responsibilities of these key managers and the base level financial management committees.

Responsibility Center Manager. Because the RCM is a line manager, he has the responsibility to manage funds and the authority to reprogram funds among elements of expense within his organization. This means he has the responsibility for the substitution of "one resource for another to obtain an optimum mix of resources to accomplish a program [43:3-1]." It is his planning and coordination which provides the direction for subordinate units to pursue in actually consuming resources (43:3-1). AFM 178-6 specifically outlines his responsibilities as follows:

1. Reviewing resource requirements of his subordinate units.

2. Integrating requirements into an RC operating budget.
3. Justifying requirements before the commander's review authorities.
4. Determining the proper distribution of his approved operating budget.
5. Analyzing the plans and performance of each RC/CC subordinate to him at the end of each month. This analysis is designed to identify imbalances in resource distribution and to insure that resource consumption contributes to mission accomplishment. This review identifies causes of overages and shortages; discusses alternative actions; and makes decisions to bring programs into line [43:3-2].

Resource Advisor. In contrast to the RCM who is a line manager, the RA is a staff manager (43:3-2). In this supportive managerial position, he accomplishes the following responsibilities:

1. Monitor the preparation of estimated requirements for resources, participate in the development of expense targets, and monitor the utilization of resources in day-to-day operations.
2. Are automatically members of the . . . FWG.
3. Are the primary point of contact with Comptroller personnel and other resource advisers on matters pertaining to resource management within their specific functions.
4. Must know the cost of his function in every detail.
5. Must have insight into the relationship between output and cost, and factors that cause this relationship to fluctuate.
6. Must have a thorough understanding of the management reports produced by the accounting system for operations and materiel system (1050-II).
7. Interprets these reports and makes recommendations for action by his RC manager [43:3-2].

Cost Center Manager. Because the cost center is the basic production organization in the chain of command, the cost center manager's chief responsibility is the



day-to-day regulation of the "consumption of manhours, supplies, equipment and services in the production of things or the performance of tasks [43:3-2]." His specific responsibilities within RMS are as follows:

1. Provides resource requirements and justification to give validity to the base operating budget.
2. Remains aware of the relationship between his daily consumption and production.
3. Provides the basis for resource realignments ultimately accomplished by superiors and financial committees (43:3-2).

Financial Committees. As discussed earlier, the FMB and FWG are the primary vehicles for base level resource management. These committees are necessary because:

Traditionally, funds allocated to an organization or activity do not satisfy total requirements. As a result, a reduction in the scope of certain programs and default or elimination of other programs become necessary . . . . Decisions to reduce, defer, eliminate programs, or determine program priorities are accomplished by coordinated efforts and collective action. . . . There is no unilateral management of programs when these programs are competing for the same limited resources. Financial management, therefore, is a function of committee action as well as an individual responsibility [38:1-4].

Stated in other words, any action by a single manager (RCM or cost center manager) to increase the consumption of resources will necessarily cause a decrease



in the consumption of resources elsewhere on the base. Conversely, any action by a single manager (RCM or cost center manager) to decrease the consumption of resources will necessarily make additional resources available for consumption elsewhere on the base.

The purpose of the management committees is to insure that scarce resources are allocated to satisfy total requirements and therefore maximize base-wide combined outputs (38:14). These committees must therefore decide how to allocate scarce resources between competing alternatives.

The ability of these committees to fulfill their purpose is dependent to a great degree on the composition of the committees. As discussed earlier, management of the resources to generate outputs (management over the consumption of resources) occurs through the chain of command or line managers (RCMs and cost center managers) (37:4-5). To provide the most effective and efficient use of resources these same line managers must be members of or represented on the committees (19). Further if the line managers are not members of the committees, but are represented by others, they must still be actively involved in decisions concerning allocation of resources (19). Otherwise, the line managers would only be concerned with managing the consumption of resources and would not be concerned with allocation of the same resources.

### Summary

The Resource Management Systems were created due to the necessity for integrating budgeting with planning. Dr. Anthony in developing the RMS used the management control model of planning, budgeting, accounting, reporting and analysis as the best process to achieve the key RMS objectives of efficiency and effectiveness. The actual RMS subsystems which exist today are the Planning, Programming and Budgeting Subsystem, the Management of Resources for Operating Activities Subsystem, the Management of Inventories Subsystem, and the Management of Capital Acquisitions Subsystem. The base level, which is very much a part of the RMS, translates congressional appropriations into mission accomplishments. The responsibilities of RCMs, RAs, and cost center managers and the actions of the FMB and FWG all work together to provide a sound structure for the base level part of the RMS.

## CHAPTER III

### METHODOLOGY

This chapter describes the methodology used in the research. The chapter includes a description of the data collection design; the methodology for answering the research question; the methodology for testing the hypotheses; and a summary of assumptions and limitations.

#### Data Collection and Analysis Design

##### Description of the Population

The universe for this research consisted of all Air Force responsibility center managers (RCMs). The population of interest in the research was a subset of the universe and consisted of Squadron Level RCMs in the Strategic Air Command (SAC), the Air Force Logistics Command (AFLC) and the Air Training Command (ATC). The population included a total of 751 responsibility centers, 486 within SAC, 59 within AFLC, and 206 within ATC (see Tables 1, 2, and 3).

Before limiting the populations to SAC, AFLC, and ATC, attempts were made to precisely define the Air Force-wide universe. The researchers contacted Air Force experts in Responsibility Center/Cost Center (RC/CC) codes at HQ Air Force Logistics Command (AFLC), the Air

TABLE 1  
RESPONSIBILITY CENTERS IN SAC

Responsibility Centers		Base																										Totals
Code	Organization	Barksdale	Beale	Blytheville	Carroll	Castle	Dyess	Ellsworth	Fairchild	F. E. Warren	Grand Forks	Griffis	Grisson	K. I. Sawyer	Kincheloe	Loring	Malmstrom	March	McConnell	Minot	Offutt	Pease	Plattsburgh	Rickenbacker	Vandenberg	Whiteman	Wurtsmith	
XX1100	Administration	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	26
XX1400	Plans & Programming	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	26
XX1500	Comptroller	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	26
XX1600	Personnel	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	26
XX2200	Organizational Maintenance	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	22
XX2300	Field Maintenance	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	22
XX2400	Avionics Maintenance	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	22
XX2500	Munitions Maintenance	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	26
XX28XX	Missile Maintenance	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	14
XX3000	Aircraft Squadrons	4	2	2	3	3	2	3	3	2	•	2	2	2	2	2	2	2	2	2	2	4	4	•	•	2	2	51
XX3100	Missile Squadrons	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	17
XX3600	Training & Education	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	26
XX4100	Supply	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	26
XX4200	Transportation	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	26
XX4300	Security Police	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	26
XX4400	Base Civil Engineer	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	26

TABLE 1--Continued

Responsibility Center		Base	
Code	Organization		
XX4500	Special Services	26	
XX4600	Services	26	
XX4700	Base Operations & Training	26	
TOTAL		486	

## SOURCES:

U.S. Department of the Air Force. Air Force Directory of Unclassified Addresses.  
AFM 10-4. Washington: Government Printing Office, May 1976.

U.S. Department of the Air Force. Responsibility/Cost Center Codes. AFM 170-5.  
Washington: Government Printing Office, May 1969.

TABLE 2  
RESPONSIBILITY CENTERS IN AFLC

Responsibility Centers*		Air Force Bases							
Code	Organization	Hill†	Kelly†	McClellan†	Newark†	Robins†	Tinker†	Wright Patter- sons‡	Total
XX1100	Administration	X	X	X	X	X	X	X	7
XX1500	Comptroller	X	X	X	X	X	X	X	7
XX1600	Personnel	X	X	X		X	X	X	6
XX4200	Transportation	X	X	X		X	X	X	6
XX4300	Security Police	X	X	X	X	X	X	X	7
XX4400	Base Civil Engineer	X	X	X	X	X	X	X	7
XX4500	Special Services	X	X	X	X	X	X	X	7
XX4600	Services	X	X	X		X	X	X	6
XX4700	Base Ops & Training	X	X	X		X	X	X	6
TOTAL									59

SOURCES:

A. F. Jerome. Pay, Travel and Management Group, HQ AFLC/ACFFP, Wright-Patterson AFB OH. Personal interviews conducted intermittently from 10 November 1976 to 12 November 1976.

U.S. Department of the Air Force. Air Force Directory of Unclassified Addresses. AFM 10-4. Washington: Government Printing Office, May 1976.

U.S. Department of the Air Force. Responsibility/Cost Center Codes. AFM 170-5. Washington: Government Printing Office, May 1969.

\*Air Base Group/Wing Responsibility Centers Only.

†AFC Directorates not included.

‡HQ AFLC and tenants not included.



TABLE 3

## RESPONSIBILITY CENTERS IN ATC

Responsibility Centers		Base*												
Code	Organization	Chanute	Columbus	Craig	Keesler	Lackland†	Laughlin	Lowry	Mathers	Randolph	Reese	Sheppard**	Webb††	Williams
XX1100	Administration	.	.	.	.	.	.	.	.	.	.	.	.	13
XX1510	Comptroller	.	.	.	.	.	.	.	.	.	.	.	.	13
XX1600	Personnel	.	.	.	.	.	.	.	.	.	.	.	.	13
XX2100	Chief of Maintenance	.	.	.	.	.	.	.	.	.	.	.	.	3
XX2200	Organizational Maintenance Squadron	.	.	.	.	.	.	.	.	.	.	.	.	8
XX2300	Field Maintenance Squadron	.	.	.	.	.	.	.	.	.	.	.	.	9
XX2400	Avionics Maintenance Squadron	.	.	.	.	.	.	.	.	.	.	.	.	9
XX37XX	Flying/Student Squadron	.	3	3	.	.	5	.	9	3	3	.	3	32
XX39XX	Tech/Field Training Groups	4	.	.	5	3	.	5	.	.	.	5	.	22
XX4110	Base Supply	.	.	.	.	.	.	.	.	.	.	.	.	13
Total		.	.	.	.	.	.	.	.	.	.	.	.	.

\*HQ ATC and Vance AFB (Contractor Operated) not included.

†Basic Military Training School not included.

§RC/CC Code 37XX included: 37XX, Training and Training Systems Division; 38XX, Flying Training Squadron; and 39XX Flying Training Squadron.

\*\*School of Health Care Sciences (SHCS) and 80th FTW not included.

††3389 Security Assistance Training Program not included.



TABLE 3--Continued

Responsibility Center		Base*												
Code	Organization	Chanute	Columbus	Craig	Keesler	Lackland+	Laughlin	Lowry	Mathers	Randolph	Reese	Sheppard**	Webb++	Williams
XX4200	Transportation	.	.	.	.	.	.	.	.	.	.	.	.	.
XX4300	Security Police	.	.	.	.	.	.	.	.	.	.	.	.	.
XX4400	Base Civil Engineer	.	.	.	.	.	.	.	.	.	.	.	.	.
XX4500	Special Services	.	.	.	.	.	.	.	.	.	.	.	.	.
XX4600	Services	.	.	.	.	.	.	.	.	.	.	.	.	.
XX4700	Base Operations & Training	.	.	.	.	.	.	.	.	.	.	.	.	.
Total														206

39

## SOURCES:

U.S. Department of the Air Force. Air Force Directory of Unclassified Addresses. AFM 10-4. Washington: Government Printing Office, May 1976.

U.S. Department of the Air Force. Responsibility/Cost Center Codes. Washington: Government Printing Office, May 1969.

Force Accounting and Finance Center (AFAFC), and HQ USAF. These experts indicated that there was no inclusive central collection of all RC/CC codes by base and major command and that the first two digits of the code were command assigned and under no control by HQ Air Force (16; 35; 36; 48).

One expert indicated that each MAJCOM staff could prepare a list of all responsibility centers on each base within the MAJCOM (48). A summary list of responsibility center codes by base could then be prepared; however, this method of defining the population size was determined to be infeasible because of the excessive time anticipated in obtaining lists for each MAJCOM.

Because no central repository for base level RC/CC codes could be found, it was decided to limit the universe to SAC, AFLC, and ATC responsibility center managers. While this decision prevented statistical inference to the entire Air Force, these commands were selected because of their distinct differences in mission and size.

#### Methods of Data Collection

There were two feasible ways to gather research data from this population: (1) to observe, and (2) to interrogate or ask people about themselves or others (9:198; 18:536). Interrogation could be subdivided into

the following methods: personal interview, questionnaire, panel, and telephone interview. Although the personal interview was considered the best gatherer of information, time constraints sometimes make it impossible to accomplish for large populations (18:414). The panel technique, considered next best by Kerlinger, used a sample of respondents, with an initial interview and then reinterviews at a later time. Since this technique is used primarily to study changes in behavior, it was not appropriate for this research (18:414). The telephone interview offered low cost but had as its principal defect the inability to obtain detailed information (18:414). The mail questionnaire was considered most appropriate for this research although it was thought by Kerlinger to have two serious drawbacks: (1) lack of response, and (2) the inability to check the responses given (18:414). With the high responsibility level of the respondents (squadron commanders and division chiefs) and with careful questionnaire design, it was believed that the negative effects of these drawbacks could be minimized.

Information concerning the specific questionnaire design is included in the following sections detailing methodology for each research question and hypothesis test.

### Sampling Plan

Type of Sample. Since data would be collected by questionnaire it was reasonable to expect that some differences would exist in the data provided by RCMs within each command. This assumption was based on the fact that, as mentioned in Chapter II, each command has an opportunity to establish its own resource management requirements. Additionally, SAC has an operational mission; AFLC has a support mission, and ATC has a training and education mission. Differences could exist between commands in base level management of resources. Accordingly, the stratified random sampling technique was selected because it is best suited for situations where differences could exist within the population (9:154-160).

Sample Size. The size of sample to be selected in each of the stratum was influenced by the statistical methods to be used in analyzing the data. The sections of this chapter detailing methodology to answer the research questions and test the research hypotheses include factor analysis and correlation analysis as the major statistical techniques employed. By convention, the normal sample size for research utilizing correlation and factor analysis should be 15 percent of the elements in each of the population stratum for a 15 percent sample would be

large enough to compensate for extreme or unusual data values as well as missing values generated by the sample (20).

In order to insure that the sample would generate responses totaling 15 percent of the population in each stratum, consideration had to be given to a possible nonresponse rate. Similar research conducted at the Air Force Institute of Technology (AFIT) had indicated a 35 percent nonresponse rate (13). This nonresponse rate was assumed to be appropriate, and procedures were developed to insure a data producing sample constituting at least 15 percent of the sample in each stratum.

The invited sample size was therefore determined for each stratum as shown in Table 4.

Sample Selection. To assure randomness in sample selection, squadron level responsibility centers were numbered as follows: SAC 1 to 486, AFLC 1 to 59, and ATC 1 to 206. A random number generator program within the CREATE Computer Library at AFLC was then used to select 113, 14, and 48 sample elements from SAC, AFLC, and ATC respectively.

Control of External Variables. Following the sample selection, a questionnaire mailing list was prepared of RCMs comprising the sample. To exercise control over external variables in the research (e.g., the passage of time and sample element maturation) the

TABLE 4  
INVITED SAMPLE DETERMINATION

SAC Stratum Population Total	486		
15 Percent Data Producing Sample Required		73	
Estimated Nonrespondents		<u>40</u>	
Total Stratum Sample			113
AFLC Stratum Population Total	59		
15 Percent Data Producing Sample Required		9	
Estimated Nonrespondents		<u>5</u>	
Total Stratum Sample			14
ATC Stratum Population Total	206		
15 Percent Data Producing Sample Required		31	
Estimated Nonrespondents		<u>17</u>	
Total Stratum Sample			<u>48</u>
TOTAL INVITED SAMPLE			<u><u>175</u></u>



questionnaire was mailed to all respondents within the same stratum at the same time. The respondents were requested to complete and return the questionnaire within five work days of receipt. A follow-up letter containing a second copy of the questionnaire was sent to those RCMs whose responses had not been received by the end of the fourth week from the initial questionnaire mailing. To determine if the follow-up and original samples were drawn from the same statistical population, the Chi-Square ( $\chi^2$ ) test for two independent samples was used. A  $\chi^2$  contingency table was constructed for each question and included the frequency of responses for both the original and follow-up sample. An appropriate hypothesis test then was conducted for each question at the 90 percent confidence level. It was determined that if 50 percent of the questions passed the hypothesis test, a single population would be assumed. If this criteria were not met, the follow-up data would be analyzed separately.

Generalization of Results. The above procedures were supported by experts in the field of research and established validity of the sampling technique and representativeness of the data collected. This validity and representativeness then, further supported generalization of appropriate research results to the parent population (2). Specific aspects of validity and



representativeness are discussed in the methodology for answering the research questions and testing the two hypotheses.

Design for the  
Research Question

*Research Question: To what extent is the squadron level responsibility center manager involved in the base resource management systems?*

Operational Definition of Involvement. The literature concerning the RMS at base level defined numerous responsibilities and tasks that are required of responsibility center managers (3; 43). For purposes of this research, "involvement" was operationally defined as the responsibility center manager's participation in the base resource management system, measured by the degree to which he accomplishes selected resource management tasks and responsibilities. The specific tasks and responsibilities selected are included in Appendix A opposite the broader major areas of emphasis.

RMS experts who participated in the SRMAG confirmed this operational definition of involvement from many observations of the base level RMS in operation. They described individuals who were involved to be those actually accomplishing the duties and responsibilities outlined in AFM 178-6, *Resource Managers Handbook* (8; 19). Air Force Institute of Technology graduate

students who had been RAs or RCMs prior to attendance in AFIT also confirmed this operational definition of RMS involvement (11; 22).

#### Procedures and Justification of Measurement

Question Design. The RCM functions in Appendix A served as the basis for construction of the measurement questions for involvement. As each specific question was developed, it was compared with this table to insure that the question concerned the RMS and would suggest a degree of involvement. The greatest value of this method came, first, in insuring that all major RMS areas were covered by questions and second, that no major RMS area was inadvertently omitted due to limiting the size of the questionnaire. The major RMS areas of emphasis were developed from extensive review of RMS literature and the opinions of experts in base level RMS (8; 19; 48). It was the opinion of these experts that the areas adequately subdivided the base RMS and would permit specific questions to measure a degree of involvement.

Once the questions to be asked were developed, the next decision facing the researchers was whether to use open or closed response forms or a combination of both (9:201). An open response required the respondents to fill in his own answer, whereas, the closed response gives the respondent

a choice from among two or more fixed answers (9:201). Disadvantages of closed questions are that they force or lead opinions and omit respondents' views. The open question sometimes elicits incoherent or indigestible answers which cannot be used for statistical analysis (9:200). While it is possible that a respondent may interpret the given answers differently, the structured frame of reference offered by the predefined alternatives in the closed response seemed better suited for responses which were to be subjected to statistical analysis (50:191). The closed response form was therefore selected for this research.

Once the decision to use closed response questions had been made, there were several important decisions which followed. The first of these decisions was selection of the type of scale which would best elicit a valid response. Would dichotomous answers be more appropriate than ones which allowed middle ground? If middle ground answers were offered, how many choices should be given to the respondent? The answers to questions such as these required consideration of many factors.

The most basic of the closed response scales is the multiple choice question. With this scale, most problem areas can be avoided by making the list of choices exhaustive, reasonably balanced, and mutually

exclusive (9:220-2). After looking at examples of this type scale, it was decided that the more complex form of closed response scales (i.e, *rating scales*) would better serve the research effort.

*Rating scales* are used "to judge properties of objects without reference to similar objects [9:237]." Here the argument over the number of scale points concluded that, with more points, greater measurement sensitivity could be achieved. Scales with three to seven points, however, have been used without much difference in results attained (9:237). The assumption in applying rating scales was that responsibility center managers could and would make good judgments, but the researchers were aware of and took precautions against three possible sources of errors: leniency, central tendency, and halo effect (9:249).

The error of leniency is primarily caused by the individual who inflates (positive leniency) the rating of someone he knows well. Someone aware of this inflation tendency consciously goes to the low extreme (negative leniency) in rating those he knows well. To overcome this error, an asymmetrical scale can be used. For example, where positive leniency is suspected, a scale with three lower descriptive terms and only one high can be used (9:241). Because there was no knowledge

or evidence in the literature review of either high or low leniency, the scales for this questionnaire were designed to be symmetrical.

The second error possibility, central tendency, is caused by a respondent's reluctance to make extreme judgments. Strong descriptive adjectives and a greater number of scale points are several ways to overcome this error situation. Both of these preventive measures were considered in development of the thesis questionnaire. As a result, the strongest descriptive terms which were already proven through reliable questionnaires were chosen for the involvement question measurement scales (26:Appendix C).

The third potential error, the halo effect, is that of rating someone high or low because of already established opinion based on traits not being rated. It is best neutralized by using traits that are clearly defined and that are easily observable (9:241). For the research questionnaire, most of the involvement questions related to responsibilities discussed in AFM 178-6, *Resource Managers Handbook*, and were considered to be clearly defined and observable (11; 22).

Validity of the Instrument. The questions developed through the above procedures are contained in Part II of the questionnaire in Appendix B. These questions

were representative of the responsibilities and tasks outlined in the literature governing the base level RMS (43:1-1 through 3-11). The first indication of validity was evidenced when the involvement questions one researcher extracted from a draft copy of *A Guide to Base Level Resource Management* (3) matched the other researcher's involvement questions extracted independently from AFM 178-6 (43). Further validity of the questions was obtained when the independent questions that the researchers extracted from the literature covered every area of involvement suggested by RMS experts and former RCMs and RAs. The belief in the validity of the questions was guided by Emory's statement that "if the instrument contains a representative sample of the universe of subject matter of interest, the content validity is good [9:120]."

To further establish validity, the questionnaire design literature was reviewed to determine areas which could cause distortion or bias in the measurement instrument. One area found to cause distortion in surveys was question wording. Some researchers believed that it actually was foremost in causing error or bias in the research (9:214). Because of its great potential for causing bias (the distortion of responses in one direction), Emory suggested the following challenges which should be satisfied before question formulation was completed:



1. Is the question stated in terms of shared vocabulary?
2. Is the question clear?
3. Are there unstated or misleading assumptions?
4. Is there biased wording?
5. Is there the right degree of personalization?
6. Are adequate alternatives presented [9:215]?

The question of shared vocabulary was viewed in terms of both the respondent and question writer. Colloquialism used in a question could hinder the respondent's understanding, whereas, in technical questioning, the questioner may not have the technical vocabulary to ask meaningful questions (9:214). This point highlighted the importance of a strong RMS literature review and understanding by the researchers.

Question clarity could probably best be achieved by testing each word in a question with the following six challenges:

1. Does it mean what is intended?
2. Does it have meaning?
3. If so, does the content make the intended meaning clear?
4. Does the word have more than one pronunciation?
5. Is there any word or similar pronunciation that might be confused?
6. Is a simpler word or phrase suggested (29:140; 9:215)?



Misleading assumptions could best be eliminated by control of the frame of reference. This was accomplished by first learning the respondent's frame of reference and then defining a portion of the frame of reference for a specific question (9:216).

Personalization is a matter of degree which was evaluated for each specific question. The split question technique of asking two questions with separate degrees of personalization about one topic was used when doubt existed as to how personalization would affect the response (9:217).

Draft copies of the questions were sent to various RMS experts for their judgment as to how well the questions measured involvement. Minor questionnaire revisions were made based on recommendations from these experts (8; 19; 48). Emory suggests this panel-of-experts method as a way to support validity (9:207).

Data Level and Range of Expected Values. Closely associated with validity was the determination of the statistical level that the data represented. Among the research experts in the behavioral sciences there is disagreement as to whether scales such as those used in this research questionnaire should be treated as ordinal or interval level data. The argument did not dispute what level the data actually is, for most agreed that it is

ordinal, but rather how the data should be treated (9:116).

With the treatment of the data at interval level, the more powerful parametric tests of statistical significance could be used, and according to Kerlinger:

If we abide strictly by the rules, we cut off powerful modes of measurement and analysis and are left with tools inadequate to cope with the problem we want to solve [18:440].

Both ordinal and interval data permit rank ordering of data and the major difference between the two levels is that a numerically equal distance scale is provided for interval data; ordinal measurements such as opinion and preference peaks are not considered to have fixed distances between intervals as do interval measurement devices such as the thermometer (9:116; 18:437). The problem of unequal intervals, according to Kerlinger, was that "distance with a scale theoretically cannot be added without interval equality [18:440]." Kerlinger's argument followed that:

Although psychological measures like attitude tests and scales are ordinal, the closer a relation approximates linearity, the stronger the assumption that the scale intervals are more nearly equal [18:440].

Furthermore, according to Kerlinger, the higher methods of analysis "work quite well with most psychological scales [18:440]." His recommendation was accepted by researchers:

Treat ordinal measurements as though they were interval measurements, but to be constantly alert to the possibility of *gross* inequality of intervals. . . . Above all, we need to be particularly careful with the integration of ordinal data to which statistical analysis suitable for interval measurement has been applied [18:441].

Data Analysis to Answer  
the Research Question

The response to each question was assigned a numerical value from one to five with one representing the lowest degree of involvement and five the highest.

With a large number of questions on involvement, the potential existed for many different variables, each representing one aspect of involvement. Because many of the questions measured similar aspects of involvement, an analysis method was sought that would reduce the number of variables while maintaining the underlying characteristics of the data. Factor analysis was selected because its:

. . . single most distinctive characteristic . . . is its data-reduction capability. Given an array of correlation coefficients for a set of variables, factor-analytic techniques enable us to see whether such that the data may be "rearranged" or "reduced" to a smaller set of factors or components that may be taken as source variables accounting for the observed interrelations in the data [27:469].

The reduced factors thus derived can then be used as measuring devices by the "construction of indicies to be used as new variables in later analysis [27:469]."

The SPSS factor analysis computer program first uses the Pearson Product-Moment Correlation procedure to calculate appropriate measures of association for the variables. Then, the program explores the data reduction possibility by constructing a new set of variables (factors) based on interactions in the data represented by the correlation coefficients. Finally, the program computes factor indices for each respondent and stores these index values on a computer file for later use. These indices were to be used to determine the degree of squadron level RCM involvement in the RMS.

To determine this degree of involvement, the SPSS frequencies program was used to summarize respondents' index values and describe the distribution, providing measures of central tendency (mean and skewness). The mean combined with the coefficient of skewness indicated the degree of RCM involvement in RMS and provided the basis for answering the research question.

#### Design for the Research Hypotheses

*Research Hypothesis 1: Squadron level responsibility center manager involvement in resource management is directly related to squadron level effectiveness.*

Operational Definition of Effectiveness. Effectiveness was defined in Chapter II in terms of the quantity and quality of output generated by organizations. While

the framework for an Air Force quality and quantity output measuring system exists in AFM 178-4, *Air Force Output Measurement/Management Indicator Systems*, there has not been Air Force-wide implementation of the system for all squadron level RCs (34; 40). This less than complete application thus precluded its use in operationally defining the variable of effectiveness.<sup>1</sup>

Another possibility for operationally defining effectiveness was seen in the results of Inspector General (IG) visitations, Resource Management Team (RMT) visits, and other similar staff assistance visits. A major problem with using these indicators of performance to operationally define effectiveness was the potential breadth of time between the date of inspection and the date of questionnaire accomplishment. Because the frequency of visitations is often between twelve and eighteen months for IG inspections and because an organization experiences a continuous turnover of military personnel, it was believed that the organizational effectiveness rating achieved twelve months earlier could not be assumed to be the same as that currently perceived by the RCM in response to the questionnaire. Thus, because the variables of time and personnel were

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<sup>1</sup>As this research was in progress, AFM 178-4 was rescinded (13).

not controlled and were subject to change, the dependent variable of effectiveness could not be assumed constant.

Another problem associated with staff assistance teams such as the RMT was the lack of an overall evaluation score or grade. Recommendations and suggestions are made, but no quantitative or qualitative *pass/fail* or *good/excellent* rating is officially awarded. Thus, another means for operationally defining effectiveness was required.

Mott conducted at least five separate surveys to measure organizational effectiveness, defining "organizational effectiveness as the ability of an organization to mobilize its centers of power for action --production and adaption [26:17]." To Mott, the more effective organization was the one which could most readily adapt to its environment while still maintaining quantity, quality, and efficiency of production (26:17). Since quality and quantity were of importance to this research's definition of effectiveness, the methodology and conclusions of Mott's efforts in measuring organizational effectiveness were studied in greater depth.

The main instrument which Mott used to measure organizational effectiveness was a questionnaire designed specifically for eliciting responses on how individuals perceived their organization's quantity, quality, and



efficiency of production. In addition, Mott asked questions designed to measure how an organization's people viewed its environmental *adaptability* and *flexibility*. Although Mott made a case for organizational effectiveness as a combination of adaptability, flexibility as well as productivity, these dimensions of effectiveness were beyond the scope of this research; only his questions on productivity were used in defining efficiency and effectiveness. Mott's two questions on quantity and quality were used to operationally define effectiveness for this research hypothesis and his question on efficiency was used similarly in Research Hypothesis 2 (26:17).

The operational definition of effectiveness was therefore the combination of production quantity and production quality as measured by the following questions:

*Production: Quantity*

Thinking now of the various things produced by the people *in your organisation*, how much are they producing?

- \_\_\_\_\_ (1) Their production is very low
- \_\_\_\_\_ (2) It is fairly low
- \_\_\_\_\_ (3) It is neither high nor low
- \_\_\_\_\_ (4) It is fairly high
- \_\_\_\_\_ (5) It is very high

*Production: Quality*

How good would you say is the quality of the products or services produced by the people in your organization?

- \_\_\_\_\_ (1) Their products or services are of poor quality
- \_\_\_\_\_ (2) Their quality is not too good
- \_\_\_\_\_ (3) Fair quality
- \_\_\_\_\_ (4) Good quality
- \_\_\_\_\_ (5) Excellent quality [26:23].

Validity of the Instrument. One proof of validity according to Emory is that what is intended to be measured is actually measured (9:120). Mott measured organizational effectiveness through a series of subjective assessments by people within the organization. The validity of his measurement was:

... supported by the assessments of top managers responsible for all the units studied in a particular organization and of people in other units whose work made them familiar with that of the units being assessed [26:21].

The validity of this research rests primarily with that previously established by Mott. Although an assessment by top supervisors and people in other units would support the validity of this research, time and money constraints precluded such assessments.

Data Level and Range of Expected Values. The same argument for assuming interval level data that was used for the variable of involvement applied to the scales used in the two questions on quantity and quality. Each scale was therefore assumed to have an equal interval between its discrete variables enumerated one through five. This classification of the data was further suggested by the fact that Mott (26:Appendix A) and other

researchers (10) had treated the data generated by these questions as interval level.

Data Scoring, Grouping and Summarizing. Mott scored each respondent's answers by assigning a numerical value to the option selected. He then established an index of effectiveness for productivity by adding the scores for quantity, quality, and efficiency and dividing by three. This yielded a "productivity scoring ranging between 1.00 and 5.00 [26:24]."

This research differed in that instead of using Mott's index, a new index called the *effectiveness index* was formed by adding the scores for quantity and quality and dividing by two. This index gave an effectiveness score ranging between 1.00 and 5.00. As in Mott's research, no index was computed for a respondent failing to answer either one or both of the index components.

*Research Hypothesis 2. Squadron level responsibility center manager involvement in resource management is directly related to squadron level efficiency.*

Operational Definition of Efficiency. Efficiency was defined in Chapter II as a measure of the relationship between organizational inputs and outputs (e.g., inputs÷outputs or cost per unit produced). As stated

for the variable of effectiveness in Research Hypothesis 1, the failure of the Air Force Output Measurement/Management Indicator System to apply to all squadron level responsibility centers precluded its use in this research (40). Similarly, the inspection/staff assistance team report method was not used for the same reasons as discussed in Research Hypothesis 1.

As seen in Research Hypothesis 1, however, Professor Mott's question of efficiency did offer a validated means for operationally defining efficiency consistent with the requirements of this research. Efficiency was, therefore, operationally defined in Mott's words as "achievement of the greatest output for the least input [26:17]," as measured by the following question:

*Production: Efficiency*

Do the people in your organization seem to get maximum output from the resources (money, people, equipment, etc.) they have available? That is, how *efficiently* do they do their work?

- ☐ (1) They do not work efficiently at all
- ☐ (2) Not too efficiently
- ☐ (3) Fairly efficiently
- ☐ (4) They are very efficient
- ☐ (5) They are extremely efficient [26:23].

Because Mott's question on efficiency was considered appropriate and would serve as a measuring device, it was adopted as the operational definition of efficiency for this research.

Validity of the Instrument. The same case for validity as was presented in Research Hypothesis 1 applied for efficiency. Because the assessment by top officials and people outside the organization supported Mott's subjective measurement from within the organization, his measurement device was considered to measure what it had intended to measure and was therefore considered valid (26:21). As was also discussed in Research Hypothesis 1, the constraints of time and funds precluded a validation method similar to Mott's.

Data Level and Range of Expected Values. Again, interval data was assumed for this measurement scale as it was for the variable of effectiveness in Research Hypothesis 1. Each scale was also assumed to have an equal interval between its discrete variables enumerated one through five. The numerical values for efficiency were arranged to increase numerically as a higher measure of efficiency was achieved. An efficiency measure of three, therefore, was considered to be higher than an efficiency measure of two.

Scoring, Grouping, and Summarizing. As in Research Hypothesis 1 on effectiveness, each respondent's answer on efficiency would be scored according to the numerical value assigned. This value by itself serves as an index of efficiency and gives an efficiency score

ranging between 1.00 and 5.00. As in Mott's research, no index would be assigned when a respondent failed to answer the question.

#### Testing the Research Hypotheses

The previously discussed involvement factor indices were compared to the effectiveness and the efficiency indices by correlation analysis. Correlation analysis can be applied if the data is ordinal or interval level (20). Since the measurement scales for the variables of involvement, effectiveness, and efficiency provide data which can be treated as interval level, this correlation was performed using the Pearson Product-Moment Correlation Coefficient (parametric) procedure (27:280-286).

To confirm or reject the research hypotheses, the results of this correlation were subjected to a test of statistical significance to determine if the correlation coefficient is statistically significantly different from zero. This statistical test was performed at the .90 level of confidence (13) in the absence of information to indicate that some other level of confidence would be more appropriate for the test. If this statistical test substantiated that respective correlation coefficients were statistically greater than zero, the researchers would conclude that the appropriate



coefficients computed from sample data would indicate a relationship of RCM involvement to effectiveness and RCM involvement to efficiency (20).

#### Assumptions

The following assumptions were made in designing the methodology for this research:

1. The questionnaire was constructed and tested in such a manner that the measurement questions would not bias respondents' opinions.
2. The respondents provided honest and factual answers based on their own knowledge, opinions, and perceptions.
3. The measurement scales used in the questionnaire provided interval level data.
4. The sampling techniques employed provided a sample that was representative of the population.
5. The sample size was adequate to compensate for the anticipated nonresponse rates.
6. The research design successfully controlled variables which were external to the research, and which could influence research results.
7. The research design enabled results to be generalized to the population.

### Limitations

The following limitations existed in this research:

1. The population was limited to responsibility centers within SAC, AFLC, and ATC. Although these commands represented a broad spectrum of resource management, generalization of results cannot be made beyond these three commands.

2. The research was conducted only on squadron/division level responsibility centers at base level and findings cannot be generalized to deputate or commander level responsibility centers or to MAJCOM or higher levels of command.

3. The time available for the research precluded employing an external measure (independent of the RCM) of responsibility center efficiency and effectiveness.

## CHAPTER IV

### DATA COLLECTION AND ANALYSIS

This chapter describes the collection of data and the analysis of the data leading to the conclusions in the next chapter. Much of the detail is included in the appendixes while the chapter summarizes the data analysis in a step-by-step fashion. The reader who is interested in the data analysis details may wish to refer to the appendixes while reading this chapter.

#### Survey Administration

As discussed in Chapter III, the sample was selected from each stratum using a computer-based random number generator program, and a questionnaire mailing list was developed to use in controlling the sampling procedure. The sample selection and mailing list preparation for the SAC and AFLC strata were completed prior to finalizing the sample selection and mailing list for the ATC stratum. The ATC selection was delayed pending receipt of an updated list of responsibility center managers from ATC.

To preclude a delay in survey administration, questionnaires were mailed to RCMs in the SAC and AFLC strata prior to receipt of the ATC list. The ATC listing

was subsequently received and questionnaires were mailed to the ATC RCMs. These two mailings comprised the original sample.

Follow-up questionnaires were mailed to RCMs whose responses to the original survey had not been received four weeks after the mailing for their stratum. These mailings comprised what is herein referred to as the follow-up sample.

The questionnaire and the cover letters used for the original and follow-up mailings are included in Appendix B. Appendix C contains information on the receipt of completed questionnaires.

As completed questionnaires were received, the control list was annotated and the demographic data on each questionnaire was reviewed in order to ascertain if the questionnaire had been completed by the intended respondent (a squadron level RCM). To preclude introducing bias in the data, questionnaires completed by individuals other than the intended respondents were eliminated from the sample.

As shown in Appendix C, this screening process eliminated seven questionnaires in the original sample and three questionnaires in the follow-up sample. Of the seven unuseable questionnaires in the original sample, two were completed by RAs at the Deputate Commander RCM level, four were completed by cost center managers

subordinate to squadron level RCMs, and one questionnaire was returned uncompleted. Similarly, of the three unuseable questionnaires in the follow-up sample, one was completed by an RA at the Deputate Commander RCM level and two were returned uncompleted.

#### Sample Tabulation

Data collection was terminated eleven weeks after the original mailing. As shown in Appendix C, the original sample generated a useable response rate of 70 percent, 71 percent, and 54 percent for SAC, AFLC, and ATC respectively. The original response rate for the ATC stratum was below the 65 percent required to provide a sample constituting 15 percent of the stratum population as discussed in Chapter III. As discussed later in this chapter, this difficulty was overcome by combining the follow-up sample with the original sample to provide a useable response rate of 84 percent, 71 percent, and 69 percent for SAC, AFLC, and ATC respectively. Therefore, with the requirement for a sample constituting 15 percent of the stratum populations satisfied, it was assumed that the sample was sufficient to compensate for extreme or unusual data values as well as missing values generated by the sample.

### Data Encoding

As completed questionnaires were received, comments were extracted (see Appendix E), and the data was placed on a computer file for later analysis. The numerical value beside each response to the questions as reflected in Appendix B was that value entered on the computer file except when a respondent failed to answer a question in which case the missing value was designated by entering a "99" on the computer file.

A peculiarity existed in assigning missing values to questions 1 through 6. Since these questions required respondents to rank certain base level managers' ability to control resources, all six questions were assigned missing values if any one of the six responses was missing. This procedure was utilized to preclude the possibility of distorted rankings in later analysis of the six questions.

After all the data was entered on the computer file, a data recoding phase began in order to place the responses to all questions on a compatible basis. For example, the raw data inputs for questions 44 and 46 were not compatible. The response scale for question 44 ranged from "(1) Their production is very high" to "(5) It is very low," whereas the response scale for question 46 ranged from "(1) Not efficiently at all" to "(5) Extremely efficiently." In this example, the two



response scales were opposites. Questions 7 through 46 were, therefore recoded where appropriate so that a scale value of (1) reflected the lowest response and a value of (5) reflected the highest response.

#### Testing the Data

After the questionnaire data had been appropriately collected and recoded, data analysis was begun. The first step in the data analysis phase was to ascertain if the data produced by the original and follow-up surveys came from the same statistical population. The data was also tested for differences in responses among the strata.

As discussed in Chapter III, the Chi Square ( $\chi^2$ ) test for two independent samples was used to determine if the original and follow-up surveys came from the same populations. Since each survey question passed the hypothesis test as shown in Appendix D, a single population could be assumed and the data from both surveys were therefore combined.

Although the data from the original and follow-up surveys had been shown to be from a single population, the question concerning differences of responses between the strata had not been addressed in the preceding test. Answering the question was critical to follow-on analysis for if there were no differences in responses between

the strata, the data could be analyzed as a whole. Conversely, if there were differences between the strata, the data would have to be analyzed separately for each stratum.

A Chi Square test was, therefore, used to determine if the responses produced by the individual strata were different. As shown in Appendix D, this Chi Square test demonstrated that the responses provided by the individual strata were similar. As a result, all further analysis was conducted on the data as a single sample without analysis of individual stratum data.

#### Data Reduction: Factor Analysis

The next step following the combination of the original and follow-up samples was the reduction of the large number of questions on involvement (Questions 7 through 38) into a smaller number of meaningful factors or groupings of questions. Because, "the single most distinctive characteristic of factor analysis is its data-reduction capability [27:469]," the factor analysis technique was used.

The data reduction was considered important for two reasons: first, the main areas of involvement could be discovered and described, and second, these main areas could then be used as a measuring device or set of indices to test the research hypotheses (27:469).

Thus, not only would factor analysis summarize the thirty-two questions on involvement into a smaller number of RMS involvement classifications, but it would also compute weighted index values for the new variables. These, index values could in turn be used to answer the research question on level of involvement and to test the relation of squadron level RCM involvement to squadron level efficiency and effectiveness.

#### A Three-Step Approach

The factor analysis procedure can be organized into the following three steps:

- (1) the preparation of the correlation matrix,
- (2) the extraction of the initial factors--the exploration of possible data reduction, and (3) the rotation to a terminal solution--the search for simple and interpretable factors [27:470].

Because these procedural steps with their appropriate computer options offered a systematic decision process for accomplishing factor analysis, they were adapted to this research.

Preparation of the Correlation Matrix. The basic decision in this initial step was to choose whether the correlation would be between variables (questions) or between pairs of individuals. Since the objective of this factor analysis was the combination of questions into broader categories, the correlation between variables option (called *R*-factor analysis) was selected.

Extraction of Initial Factors. This step required the decision to extract a new set of variables or factors from the original data based on either a mathematical or inferred structuring of variation in the original variables. Rather than assume linearity as the best explanation of variance as required by the mathematically defined option, the inferred or classical-factor analysis technique was chosen. Here, the assumption was simply that there was "some underlying regularity in the data [27:471]," and that the new variables are a result of both common influence by the original variables and some unexplained or unique influence. The basic model is expressed as follows:

$$Z_j = a_{j1}F_1 + a_{j2}F_2 + \dots + a_{jm}F_m + d_j U_j \quad (1)$$

$$j = 1, 2, \dots, n$$

where:

- $Z_j$  = Variable  $j$  in standardized form
- $F_i$  = Hypothetical factors ( $i=1, 2, \dots, m$ )
- $U_j$  = Unique factor for variable  $j$
- $a_{ji}$  = Standardized multiple regression coefficient of variable  $j$  on unique factor  $i$  (factor loading)
- $d_j$  = Standardization regression coefficient of variable  $j$  on unique factor  $j$ .

Additionally, the following correlations are assumed to hold among the hypothesized variables:

$$r(F_i, U_j) = 0 \quad i=1,2,\dots,n; j=1,2,\dots,n;$$

$$r(U_j, U_k) = 0 \quad j \neq k$$

The meaning of the above is that the unique factor,  $U_j$ , is "assumed to be orthogonal<sup>1</sup> to all the common factors and to the unique factors associated with other variables" (27:471). The conclusion, therefore, is that any correlation between variables (questions) is due to the common factors.

Three terms used later in this treatment of factor analysis, i.e., communality, eigenvalue, and variance, must now be understood with respect to formula 1 above. The first term, communality, is expressed by the following formula and is defined as the percentage of the variance in a variable accounted for by the common factors.

$$\text{Communality} = a_{11}^2 + a_{12}^2 + \dots + a_{1i}^2 \quad (2)$$

The second term, eigenvalue, is expressed by formula 3 and is to be thought of as the amount of total variance in the data accounted for by a specific factor.

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<sup>1</sup>"Orthogonal Factors are uncorrelated [27:472]."

$$\text{Eigenvalue} = \sum_{j=1}^n a_{j1}^2 \quad (3)$$

The third term, total variance, is comprised of two components: explained and unexplained (or unique) variance. Referring to formula 2 above, the explained variance for a variable (question) is the communality, and the unexplained variance is (1-communality). In formula 1 above, the coefficient  $d_j$  is equal to the expression  $\sqrt{1-\text{communality}}$ . The proportion of variance in the data accounted for by a factor is equal to the sum of the eigenvalues divided by the number of variables as shown by the following:

$$\frac{\sum_{j=1}^n a_{j1}^2}{n} \quad (4)$$

where:  $n$  = Number of variables (27:478).

The total variance explained by a matrix of variables and factors is equal to either the sum of communalities or the sum of the eigenvalues.

Rotation of Factors into Terminal Factors. Once factors are extracted from the variables, the purpose of the rotation of factors is "somehow to achieve simpler



and theoretically more meaningful factor patterns [27:472-3]." Basically, the choice is between oblique and orthogonal rotation with both methods designed to obtain the simplest and most meaningful factor structure (27:484). Because orthogonal factors are uncorrelated, the orthogonal type rotation was selected. Three choices were available for orthogonal rotation: varimax, equimax and quartimax. This research was concerned with simplifying the explanation of the factors, varimax rotation was chosen because it ". . . finds the rotation position that simplifies the description of each factor by maximizing the variance of its factor loading [49:90]." Quartimax on the other hand emphasizes simplification of the variables, resulting in general factors, and equimax is a compromise between quartimax and varimax (27:485).

In summary, therefore, the three steps of factor analysis as applied to this research were (1) to correlate variables, (2) to extract initial factors, and (3) to rotate to a terminal solution using the varimax technique.

One last point needs to be addressed, however, before describing the actual reduction of the thirty-two questions; that is the treatment of missing values. In order to utilize as much data as possible, pairwise deletion of missing data was selected. Here, a case was only omitted from the computation of a given

correlation coefficient when the values of either of the variables being considered was missing. This procedure allowed maximum use of the data in computing simple correlations to be used in the factor analysis (27:504).

#### Data Reduction of Thirty-Two Questions

In order to clearly define involvement, it was necessary to reduce the thirty-two questions of RMS involvement (questions 7 to 38; see Appendix B) into a smaller number of meaningful variables. The accomplishment of that task is described below.

Number of Factors. As stated earlier, the first step of the Factor Analysis procedure was preparation of the correlation matrix using correlations between the thirty-two questions. Using this matrix as the input, the factor program produced eigenvalues and respective variances as shown in Table 5.

This table of eigenvalues and variances was then subjected to the Kaiser Criterion and the Cattell Scree Test to determine the number of factors that should be extracted from the variables.

The Kaiser Criterion "specifies that only factors with factor contributions (eigenvalues) of 1.0 or greater should be retained in a factor analysis [49:87]." This criterion eliminated factors eleven through thirty-two from further consideration.

TABLE 5  
EIGENVALUES AND EXPLAINED VARIANCE FROM  
THE INITIAL CORRELATION MATRIX

Factor	Eigenvalue	Total Percentage of Variance Explained	Cumulative Percentage
1	7.83575	24.5	24.5
2	2.32287	7.3	31.8
3	2.04677	6.4	38.2
4	1.80030	5.6	43.8
5	1.56879	4.9	48.7
6	1.35218	4.2	52.9
7	1.27160	4.0	56.9
8	1.15227	3.6	60.5
9	1.06598	3.3	63.8
10	1.03218	3.2	67.0
11	0.94844	3.0	70.0
12	0.88651	2.8	72.8
13	0.84377	2.6	75.4
14	0.77079	2.4	77.8
15	0.71884	2.2	80.0
16	0.66201	2.1	82.1
17	0.58370	1.8	83.9
18	0.56592	1.8	85.7
19	0.53378	1.7	87.4
20	0.49072	1.5	88.9
21	0.45402	1.4	90.3
22	0.43296	1.4	91.7
23	0.40686	1.3	93.0
24	0.36819	1.2	94.1
25	0.32301	1.0	95.1
26	0.31055	1.0	96.1
27	0.27543	0.9	97.0
28	0.26178	0.8	97.8
29	0.23644	0.7	98.5
30	0.19053	0.6	99.1
31	0.16880	0.5	99.6
32	0.11825	0.4	100.0

Next, Cattell's Scree Test was applied to further eliminate factors "which have equal and low factor contributions [49:88]." As recommended by Cattell, a two-dimensional plot was accomplished (Figure 4) showing "factors numbered in order of extraction on the horizontal axis and size of factor contributions [percentage of variance] on the vertical axis [49:88]." The purpose of this plot, according to Cattell, was to:

Define a scree, or a point at which it [the curve] becomes horizontal, or nearly so . . . . All factors to the left of this point are real factors; those to the right are error or residual factors [49:88].

As can be seen from Figure 4, the scree was clearly defined at Factor 6. By combining the data from Figure 4 and Table 5, factors to the right of Factor 5 (Factors 6 through 10) had low factor contributions which were essentially equal. As a result, Factors 6 through 10 were eliminated from consideration and the five-factor solution was selected for the third step of factor analysis, rotation to a terminal solution. From the varimax rotated factor matrix, the maximum factor loading for each question was identified as was the grouping of questions beneath each factor. The results of this solution are shown in Table 6.

Validity of the Factor Structure. The next step of the factor analysis procedure was to establish the validity of the five factors. Factor analysis results

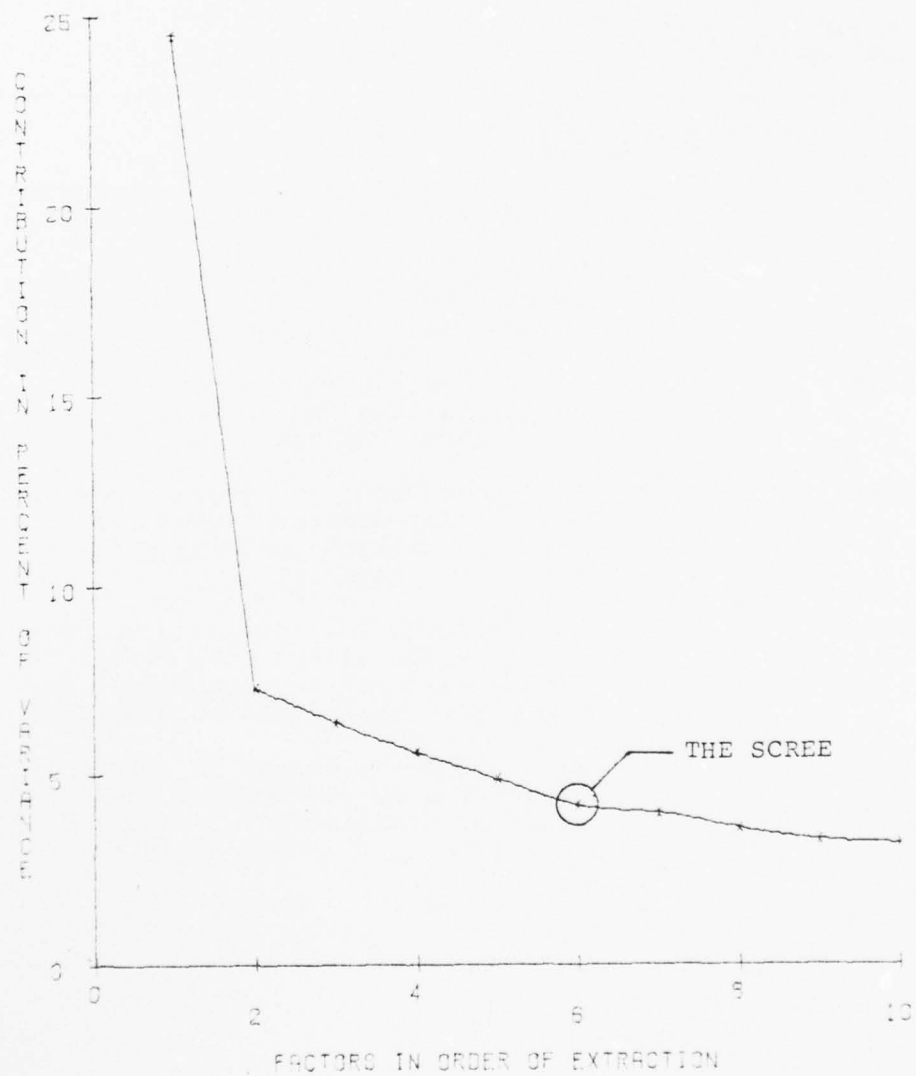


Figure 4. The Scree Test

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A COMPARISON OF SQUADRON LEVEL PERFORMANCE AND RESPONSIBILITY C--ETC(U)  
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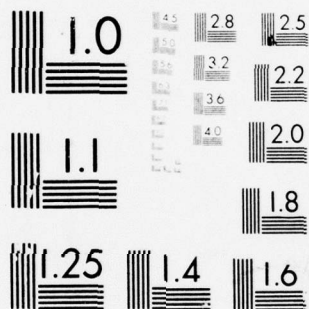
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MICROCOPY RESOLUTION TEST CHART  
NATIONAL BUREAU OF STANDARDS-1963-A

TABLE 6

QUESTIONS BENEATH EACH FACTOR--FIVE FACTORS;  
THIRTY TWO QUESTIONS

Factor Loadings	Questions
<u>Factor 1</u>	
.78640	29. Do you review the resource requirements of your subordinate units?
.75723	30. How many of your subordinate cost centers do you review to determine if overages and shortages exist?
.56075	38. How frequently do you request the Responsibility Center Manager's Cost Center reports?
.42846	33. Does your Resource Advisor work with Comptroller personnel when questions arise on matters pertaining to resource management?
.42523	11. How often do you examine your Responsibility Center and Cost Center "Balance Available" and "Due-Outs" for stock fund equipment and supplies?
.42097	16. How frequently do you or someone designated by you monitor individual materiel transactions as recorded in the Daily Document Register?
.28621	28. Do you use the Responsibility Center Management Advisory Notice percentage parameters to help monitor your funds?
<u>Factor 2</u>	
.70245	8. How much knowledge does your Resource Advisor have about the Operations and Maintenance costs incurred by your organization?

TABLE 6--Continued

Factor Loadings	Questions
.69458	35. Does your Resource Advisor monitor the day-to-day utilization of resources in your organization?
.69239	9. How much does your resource advisor support (assist and advise) you in reviewing and monitoring the overall resource management program?
.63065	13. How <u>involved</u> is your Resource Advisor in developing expense targets?
.45814	17. What portion of your resource management decisions does your Resource Advisor make for you?
.32795	10. Are your organization's requirements considered when your supervisor establishes his operating budget?

Factor 3

.72788	18. When you generate savings are you allowed to use them for your own unfunded requirements?
.61282	34. I can reprogram my savings for my organization's use.
.58477	20. I determine the distribution of my approved operating budget.
.51320	12. To what degree are your expenditures controlled by higher level financial administrators (people above you in the chain of command)?
.45030	15. To what degree can you substitute one resource for another to obtain an optimum mix of resources?
.36985	31. I am permitted to distribute targets for EEICs to my subordinate cost centers.

TABLE 6--Continued

Factor Loadings	Questions
.32051	7. What portion of your unit's resources do you actually manage?
.31681	21. What portion of your financial management recommendations reach the Financial Working Group or Financial Management Board?
<u>Factor 4</u>	
.68473	32. Do you explain your variances from EEIC targets at Financial Working Group meetings?
.54657	37. How often does your commander review your financial program?
.49866	23. What portion of the time does your supervisor ask for your advice concerning the affect of resource reductions?
.48585	14. Does your Commander or Financial Management Board Chairman encourage your attendance at FMB meetings?
.47694*	36. How often does your Resource Advisor brief you on the management report produced by the base-level accounting systems (the 1050-II and B-3500 computer printouts)?
<u>Factor 5</u>	
.62052	24. Do the Financial Management Board and the Financial Working Group use inputs developed by cost center managers as the basis for resource realignments?

\*Question 36 also had a factor loading of .42205 on Factor 2.

TABLE 6--Continued

Factor Loadings	Questions
.52485	26. When cutbacks in resources (men, time, material, money) are necessary, do you contact your Cost Center Manager for his assessment?
.48886	25. How valid are the resource requirements and justifications submitted by your Cost Center Managers?
.42574	22. Do <u>you</u> use the estimates of resource requirements and justification developed by your Cost Center Managers?
.40927	19. Are you required to justify your organizational requirements before the Commander's review authorities (Financial Management Board, Financial Working Group, etc.)?
.28002	27. When cutbacks in resources (men, material, time, money) are necessary, are you contacted for your assessment?

should contain both convergent and discriminant validity (33:37-85). Convergent validity means that a variable maximally loads on a single factor in accordance with a criteria established by the researchers (33:43). Discriminant validity, on the other hand, means that a question should not only maximally load on a factor, but it should also be appropriate to that factor when the stem of the question is compared to the stems of other questions also loading maximally on that factor (33:61).

As can be seen in the question groupings for the five-factor solution, meaningful factor patterns had emerged, but there were situations which detracted from convergent and discriminant validity. As an example of the lack of convergent validity, the maximal factor loading for question 27 was beneath Factor 5, yet it was only .28002. This meant that Factor 5 only explained 7.8 percent [ $100 \times (.28002)^2$ ] of the variation in question 27. Additionally, the communality for question 27 of .21849 indicated that all of the factors combined only explained 21.8 percent of the variance for question 27. This low factor loading and low communality were an indication that the question could not be counted on to contribute meaningfully to convergent validity. In addition, "if a variable loads on more than one factor . . . , the 'meaning' of that variable is no longer simple: It measures more than one



theoretical dimension [27:475]." For example, in the five-factor solution, the relatively high multiple loadings for question 36 suggested that the question was actually asking two or more things depending upon how the respondent interpreted it. In fact, question 36 did refer to more than one thing when it asked about reports from the Base Level accounting System (B3500) and about reports from the Supply System (1050-II). Thus, the high multiple loadings as well as low factor loadings detracted from convergent validity.

The lack of discriminant validity was seen when some questions did not logically belong to the factors when stems were compared. For example, in the five-factor solution, question 33 loaded on Factor 1 along with questions 11, 16, 28, 29, 30 and 38. All questions except question 33 concerned RCM review and monitoring of resource consumption, whereas question 33 asked if the RA coordinated with comptroller personnel.

Since the final factors were to be used to define areas of RMS involvement and to measure the degree of RCM involvement in each area, the establishment of convergent and discriminant validity was the next step. Establishing these types of validity could be best accomplished by elimination of inappropriate questions.

Because of factor rotation, the elimination of questions presented no problem for as suggested by

Rummel:

One of the chief justifications for simple structure rotation is that it determines invariant factors. . . . An invariant factor solution will delineate the same clusters of relationships regardless of the . . . variables included in the analysis [31:475].

Therefore, to provide convergent validity by elimination of questions from the factor analysis, the following rules were applied as a criteria for eliminating questions.

Eliminate a question if:

1. The highest factor loading is below .4,  
or if;
2. The communality is below .2, or if;
3. Two factor loadings for a given question  
are above .4 (23).

Table 7 illustrates that seven questions were eliminated from the five-factor solution using these rules. It must be noted in this example that the questions with loadings less than .4 were those for which the respective factor explained less than 16 percent of the question's variance. Further, the communality criteria did not eliminate any question, for the only two questions with communalities less than .2 were also eliminated for factor loadings below .4.

TABLE 7  
QUESTIONS DELETED USING FACTOR LOADING  
AND COMMUNALITY RULES

Question	Factor Loading (Variance)	Communality (Varimax)
7	.32051	.18089
10	.32795	.18923
21	.31681	.25497
27	.28002	.21849
28	.28621	.20415
31	.36985	.34264
36	.42705/.47694	.56872

Question

7. What portion of your unit's resources do you actually manage?
10. Are your organization's requirements considered when your superior establishes his operating budget?
21. What portion of your financial management recommendations reach the Financial Working Group or Financial Management Board?
27. When cutbacks in resources (men, material, time, money) are necessary, are you contacted for your assessment?
28. Do you use the Responsibility Center Management Advisory Notice percentage parameters to help monitor your funds?
31. I am permitted to distribute targets for EEICs to my subordinate cost centers.
36. How often does your Resource Advisor brief you on the management report produced by the base-level accounting systems (the 1050-II and B-3500 computer printouts)?

To this point, seven questions had been eliminated and convergent validity established. Discriminant validity, however, had not been accomplished due to the loading of questions 19 and 33 on inappropriate factors. As the final step of establishing validity, these questions were also eliminated.

To support Rummel's believe that elimination of variables (questions) would not affect the results of the rotated factor analysis solution, and to obtain final factor score coefficients for later factor index computations, a total factor analysis procedure using five factors was accomplished for the 23 remaining questions (see Table 8). As Rummel had suggested, the question groupings were unchanged by elimination of the nine variables.

#### Degree of RCM Involvement in the RMS

Since the factor analysis technique appropriately reduced the data into five factors, it was decided to describe the degree of RCM involvement in the RMS in terms of each of these factors. As indicated in Chapter III, the degree of RCM involvement was to be determined by summarizing respondents' index values for each factor in a histogram and providing measures of central tendency for each distribution. Such a methodology, however, would have merit only if a distinction could be

TABLE 8

## QUESTIONS BENEATH EACH FACTOR--TERMINAL SOLUTION

Factor Loadings	Questions
<u>Factor 1: RCM Review and Monitoring of Resource Consumption</u>	
.83974	29. Do you review the resource requirements of your subordinate units?
.72296	30. How many of your subordinate cost centers do you review to determine if overages and shortages exist?
.58182	38. How frequently do you request the Responsibility Center Manager's Cost Center reports?
.40358	11. How often do you examine your Responsibility Center and Cost Center "Balance Available" and "Due-Outs" for stock fund equipment and supplies?
.38120	16. How frequently do you or someone designated by you monitor individual materiel transactions as recorded in the Daily Document Register?
<u>Factor 2: RCM Use of the Resource Advisor</u>	
.75609	8. How much knowledge does your Resource Advisor have about the Operations and Maintenance costs incurred by your organization?
.71138	9. How much does your resource advisor support (assist and advise) you in reviewing and monitoring the overall resource management program?
.65953	13. How <u>involved</u> is your Resource Advisor in developing expense targets?



TABLE 8--Continued

Factor Loadings	Questions
.65871	35. Does your Resource Advisor monitor the day-to-day utilization of resources in your organization?
.46628	17. What portion of your resource management decisions does your Resource Advisor make for you?
<u>Factor 3: RCM Control of Resources</u>	
.79596	18. When you generate savings are you allowed to use them for your own unfunded requirements?
.62671	34. I can reprogram my savings for my organization's use.
.53120	20. I determine the distribution of my approved operating budget.
.48829	12. To what degree are your expenditures controlled by higher level financial administrators (people above you in the chain of command)?
.42607	15. To what degree can you substitute one resource for another to obtain an optimum mix of resources?
<u>Factor 4: RCM Interface with the Commander and Financial Management Committees</u>	
.65411	32. Do you explain your variances from EEIC targets at Financial Working Group meetings?
.60594	37. How often does your commander review your financial program?



TABLE 8--Continued

Factor Loadings	Questions
.53820	23. What portion of the time does your supervisor ask for your advice concerning the affect of resource reductions?
.50092	14. Does your Commander or Financial Management Board Chairman encourage your attendance at FMB meetings?
<u>Factor 5: RCM Interface with Subordinant Cost Centers</u>	
.65765	24. Do the Financial Management Board and the Financial Working Group use inputs developed by cost center managers as the basis for resource realignments?
.56342	25. How valid are the resource requirements and justifications submitted by your Cost Center Managers?
.46311	22. Do <u>you</u> use the estimates of resource requirements and justification developed by your Cost Center Managers?
.41184	26. When cutbacks in resources (men, time, material, money) are necessary, do you contract your Cost Center Manager for his assessment?

drawn between high and low involvement. The measurement scales used in generating the data (questionnaire responses) provided such a distinction between high and low involvement in that the mid-point of the scale (three for both raw and encoded data) divided the responses into two categories: one representing high involvement and the other representing low involvement. However, when the data was transformed into factor index scores for each case as shown in Appendix F, the capability to distinguish between high and low involvement was lost because the index scores were computed using standardized question responses. This procedure "means that the scores have been scaled so that they have a mean of zero and about two-thirds of the values lie between +1.00 and -1.00 [31:470]." Accordingly, an alternate method was sought to describe RCM involvement in the base RMS.

Based on a similar technique employed by Mott in his development of indices, the best alternative appeared to be the computation of average responses for the primary questions contained in each of the five factors (26:23). These average scores were therefore computed for each case as outlined in Appendix G. To insure that these averages were representative of the five-factor indices, a correlation analysis was performed between the average scores and the factor index scores for each factor.

Table 9 shows the results of this correlation analysis. The respective correlation coefficients were not only statistically significantly different from zero at the 99.9 percent confidence level, but were also of sufficient magnitude (greater than .75) to conclude that the two different measures of each factor were strongly related. Since a strong relationship existed between the two measures, it was decided to describe squadron level RCM involvement in each factor by substituting the average score in place of the factor index for each factor.

Factor 1: RCM Review and  
Monitoring of Resource  
Consumption

Figure 5 shows the histogram of the average scores in Factor 1. The vertical axis contains score value categories while the horizontal axis contains the frequency of respondents. In addition, the number of respondents contained in each category is included opposite the score value categories along the vertical axis. For example, the score value category 4.8 to 5.0 contains ten respondents, the category 4.6 to 4.8 contains three respondents, etc.

As can be seen from Figure 5, a large majority of respondents (90.99 percent) indicated high involvement in the review and monitoring of resource consumption in that their average factor scores were grouped predominantly

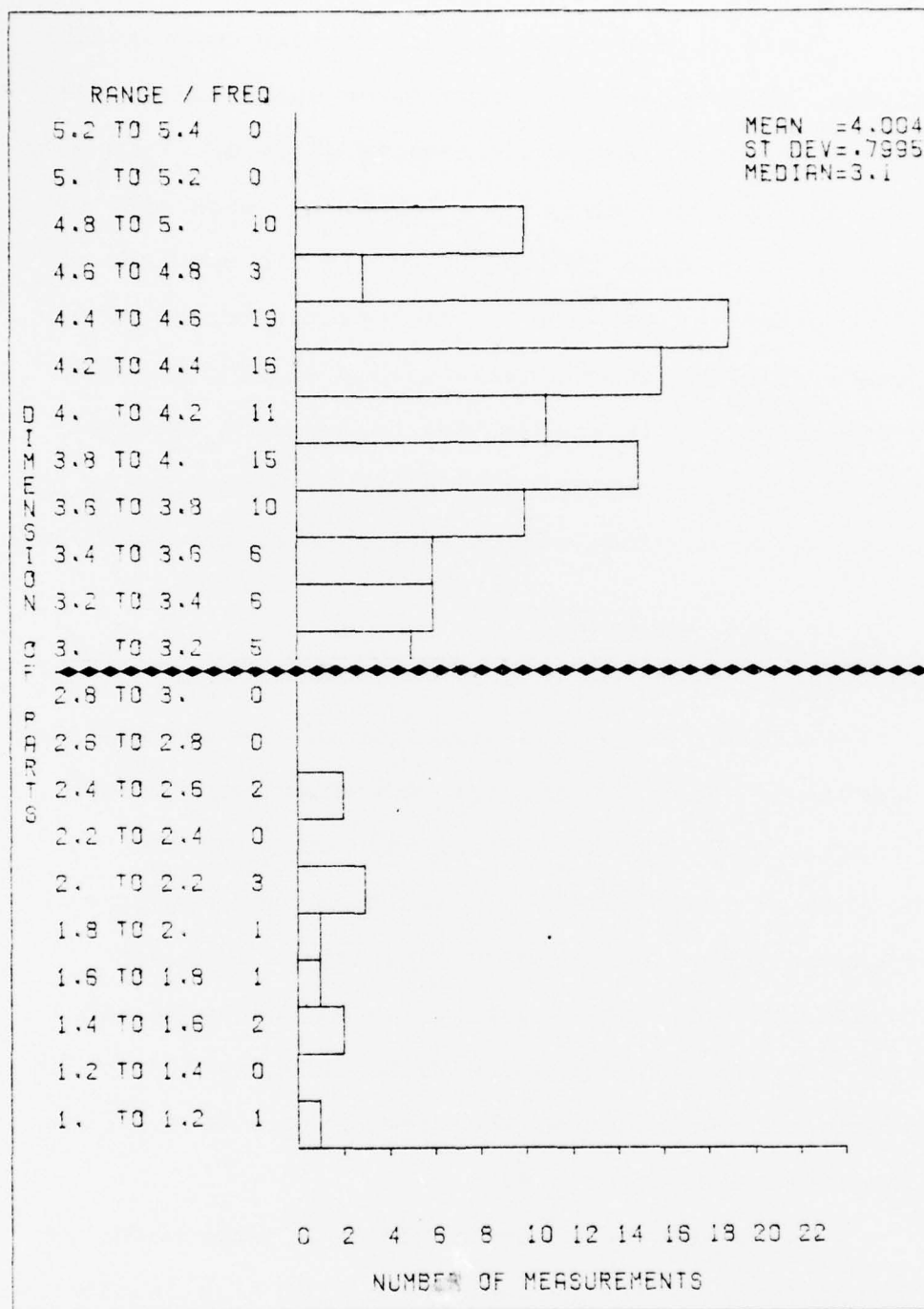


Figure 5. Histogram of Factor 1: RCM Review and Monitoring of Resource Consumption

TABLE 9  
CORRELATION OF FACTOR INDEX SCORES  
WITH AVERAGE SCORES

	Correlation Coefficients	Percent of Confidence
Factor 1	.9094	99.9
Factor 2	.7542	99.9
Factor 3	.9210	99.9
Factor 4	.9234	99.9
Factor 5	.9016	99.9

above the scale mid-point of three. The mean score was 4.004. The coefficient of skewness was computed to be -1.434 which indicated that the respondents were grouped together in the area of high involvement (6:44).

Factor 2: RCM Use of the  
Resource Advisor

Figure 6 shows that a large number of respondents (93.69 percent) indicated a high degree of involvement in utilizing their resource advisors within the base Resource Management Systems. The mean score was 3.987 and the coefficient of skewness (-1.350) indicated that the respondents were grouped together in the area of high involvement (6:44).

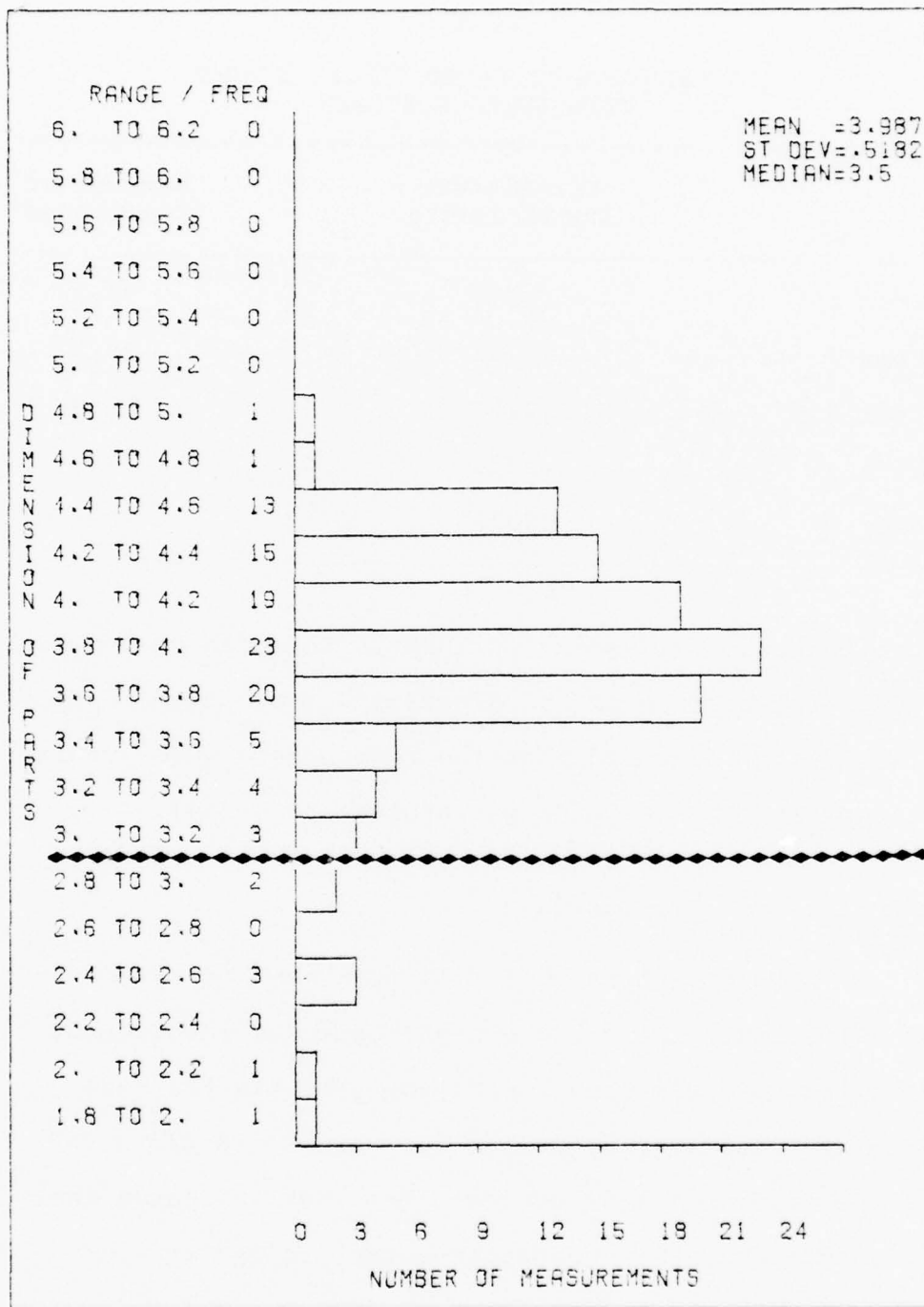


Figure 6. Histogram of Factor 2: RCM Use of the Resource Advisor



Factor 3: RCM Control  
of Resources

Figure 7 shows the RCM involvement in the control of resources was relatively lower than involvement in the first two factors. This contention of lower involvement was supported in three ways. First, only 58 percent of the respondents indicated high involvement in this factor compared to over 90 percent in the first two factors. Second, the mean score of 3.231 was closer to the scale midpoint than were the means of the first two factors. Third, the coefficient of skewness, -0.408, indicated a fairly symmetrical distribution which placed more respondents in the area of low involvement (6:44).

Factor 4: RCM Interface with  
the Commander and Financial  
Management Committees

Figure 8 shows that the RCM interface with the commander and financial management committees was also relatively lower than involvement in the first two factors for the same reasons stated in Factor 3: only 57 percent of the respondents indicated high involvement; the mean score of 3.243 was close to the scale midpoint; and the coefficient of skewness, -0.352, indicated that more respondents were in the area of low involvement.

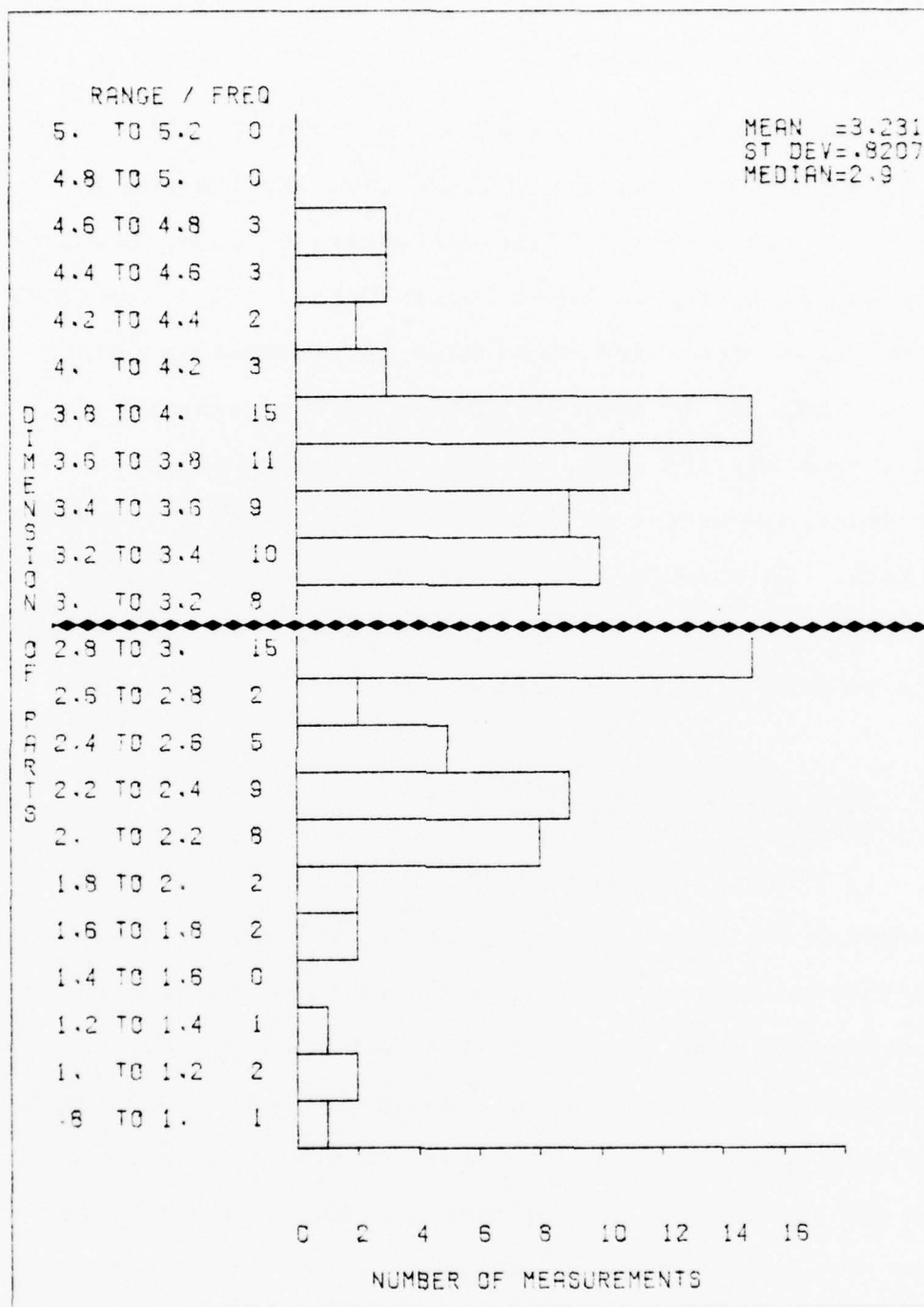


Figure 7. Histogram of Factor 3: RCM Control of Resources

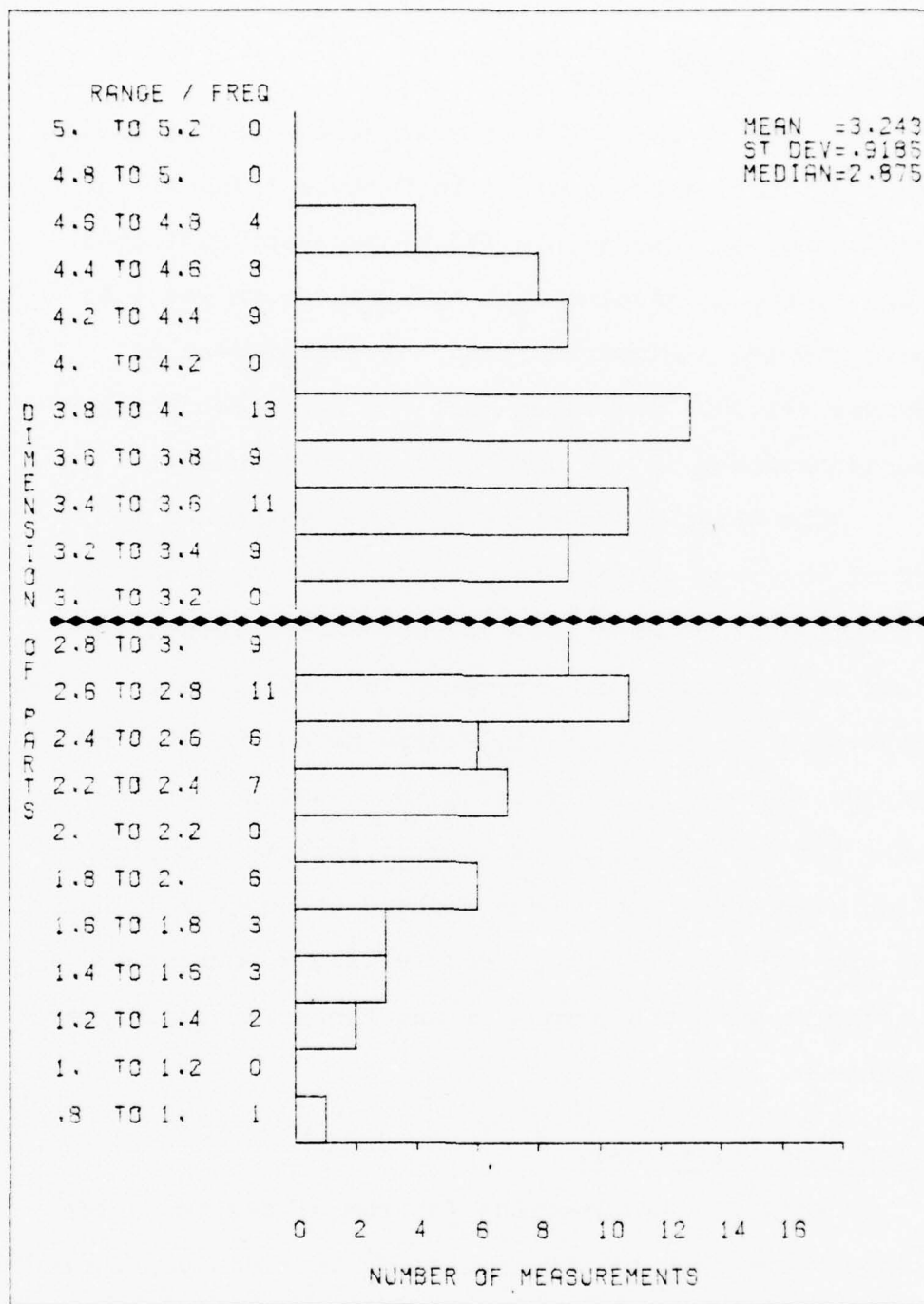


Figure 8. Histogram of Factor 4: RCM Interface with the Commander and Financial Management Committees

#### Factor 5: RCM Interface with Subordinate Cost Centers

Figure 9 shows that RCM interface with subordinate cost centers was similar to Factors 1 and 2. A large number of respondents (93.69 percent) indicated a high degree of involvement; the mean score was 4.05 (above the scale midpoint); and the coefficient of skewness (-1.373) indicated that the respondents were grouped together in the area of high involvement.

The above discussions of RCM involvement in each of the five factors indicated differing degrees of involvement between the factors, but no factor contained an indication of extremely low involvement. Squadron level RCM involvement in reviewing and monitoring resource consumption, utilizing the resource advisor within the base Resource Management Systems, and interfacing with subordinate cost centers was generally higher than was RCM involvement in controlling resources and in interfacing with the commander and financial management committees.

#### Analysis of Allied Data

Possible explanations for the differing degrees of involvement may be obtained from questions not included in the factor analysis. The respondents' rankings of certain base level managers' ability to control resources (Questions 1 through 6) and the respondents indicated

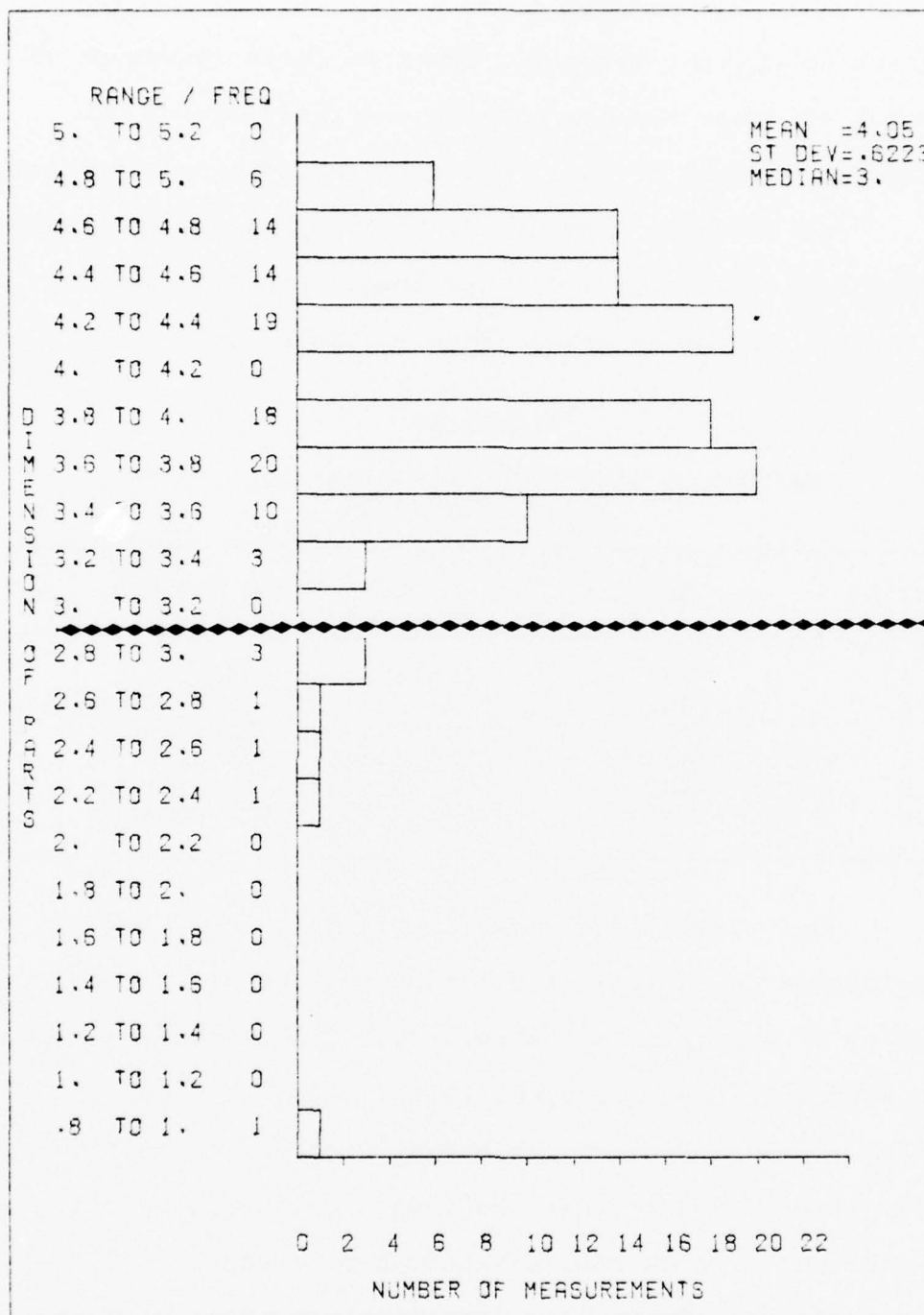


Figure 9. Histogram of Factor 5: RCM Interface with Subordinate Cost Centers

ability to control different types of funds (Question 39 through 43) were seen as possible explanations of the different degrees of involvement indicated in each factor.

As shown in Appendix H, the respondents generally agreed that the ranking of base level managers' ability to control resources is as shown in Table 10.

TABLE 10  
RANKING OF BASE LEVEL MANAGERS' ABILITY TO  
CONTROL RESOURCES

Ranking	Sum of Ranks	Base Level Manager
1	282	The Wing Commander
2	400	The Deputate Level Commander
3	424	The Squadron Level RCM
4	426	The Budget Officer
5	484	The Resource Advisor
6	545	The Cost Center Manager

One possible explanation for relatively low RCM involvement in the factor relating to control of resources (Factor 3) was seen in the relatively close ranking of RCM and Budget Officer evidenced by the respective sum of ranks. This ranking of the Budget Officer was particularly interesting in that the budget officer is a staff element and as such should not control resources (43:3-1).

To gain further insight into the relatively low RCM involvement in the factor relating to the control of resources (Factor 3), Figures 10 through 14 show the



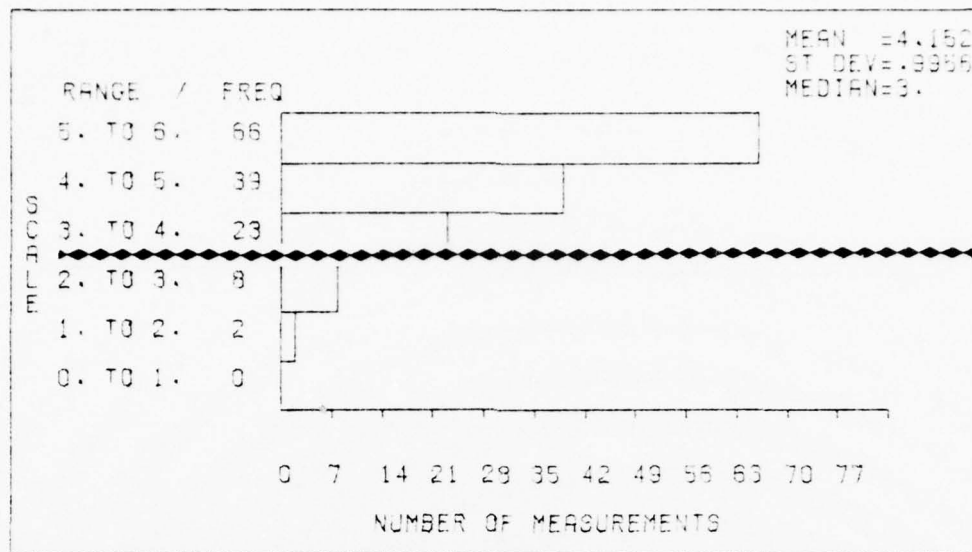


Figure 10. Controllability of Supply Funds

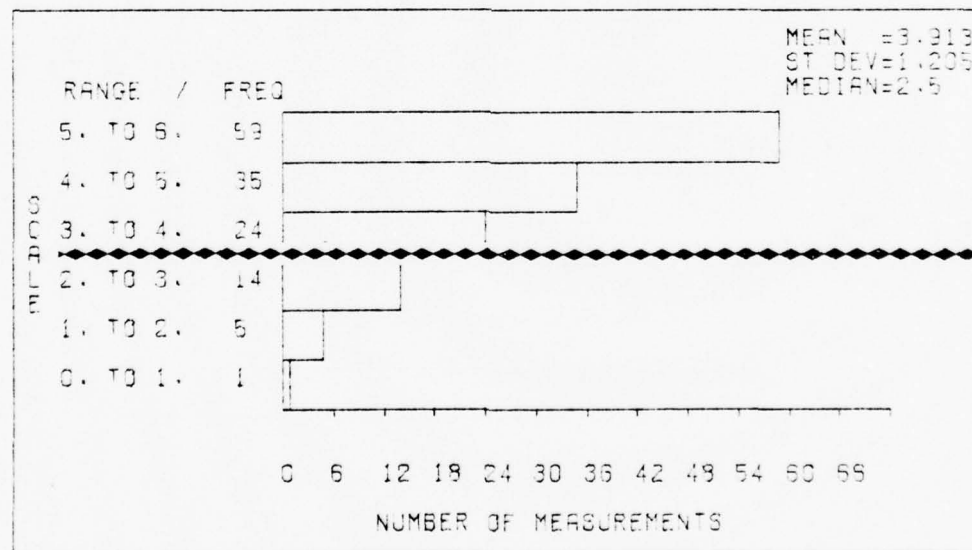


Figure 11. Controllability of Equipment Funds

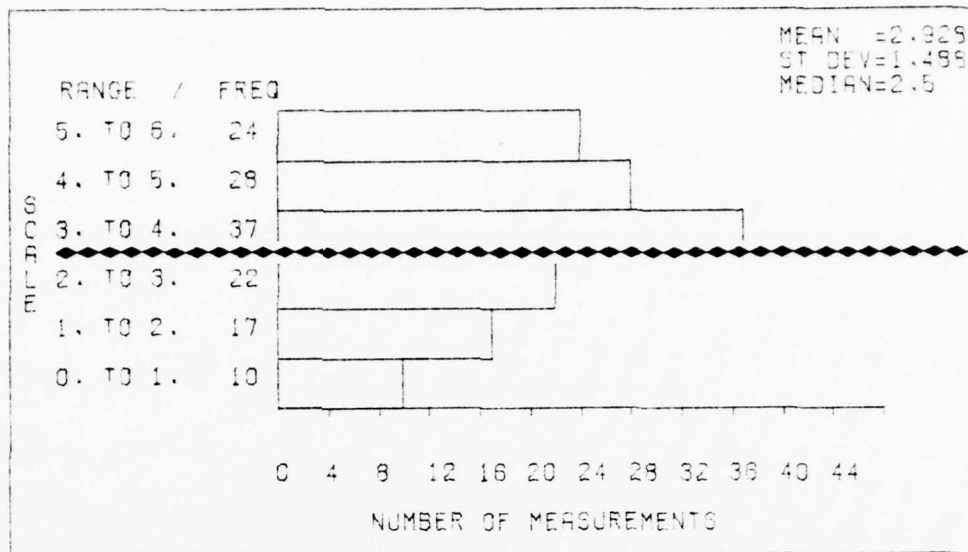


Figure 12. Controllability of Travel and Transportation Funds

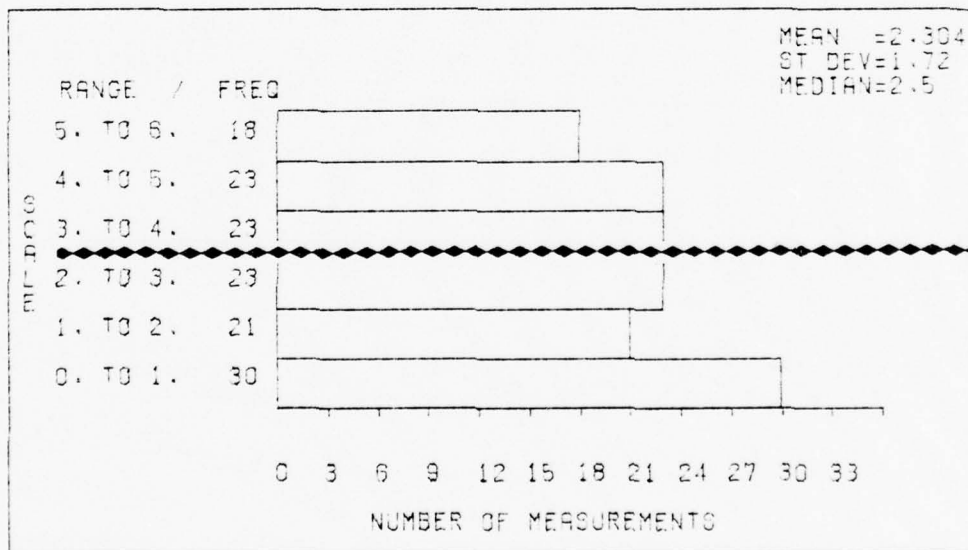


Figure 13. Controllability of Contractual Service Funds

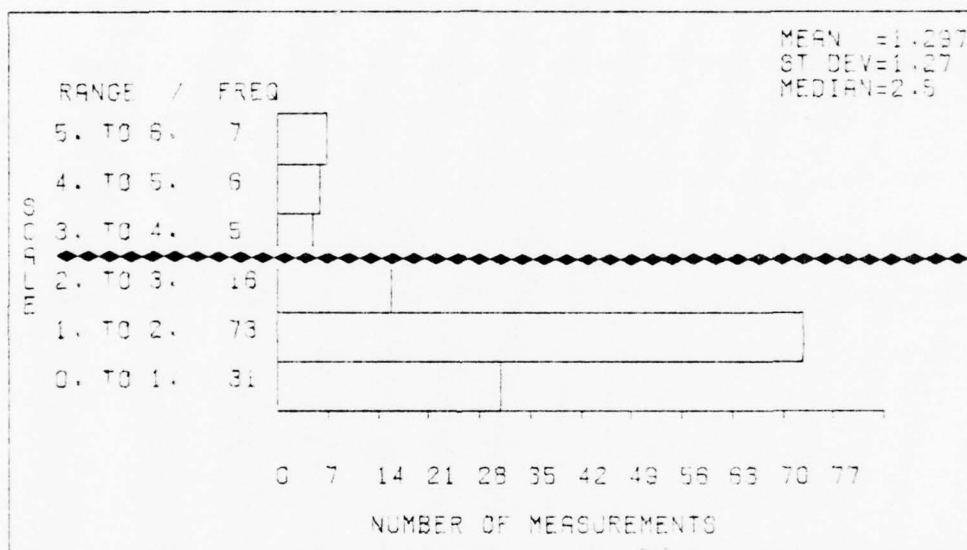


Figure 14. Controllability of Civilian Pay Funds

respondents' perceived ability to control different types of funds. The respondents indicated the greatest ability to control funds for supplies and equipment. Ability to control civilian pay, TDY, and Contract Services funds, on the other hand, ranged from low to mixed. This perceived inability to control three of the five types of funds could partially account for the relatively low RCM involvement in the control of resources and the interface with the commander and financial committees (Factors 3 and 4).

The above discussions of lower RCM involvement in the two factors are included only as possible explanations. Because the research design precluded testing these possibilities, the explanations should not be considered as conclusions of this research.

#### Testing the Research Hypotheses

Before testing the research hypotheses, the effectiveness and efficiency indices were computed for each respondent as discussed in Chapter III. The effectiveness index was computed by adding each respondent's scores for the quantity and quality of work produced (Questions 44 and 45) and dividing by two. The efficiency index was simply the response to Question 46.

In order to describe organizational effectiveness and efficiency, the histograms shown in Figure 15 and 16 were developed. The respondents indicated a high degree of organizational effectiveness and efficiency as can be

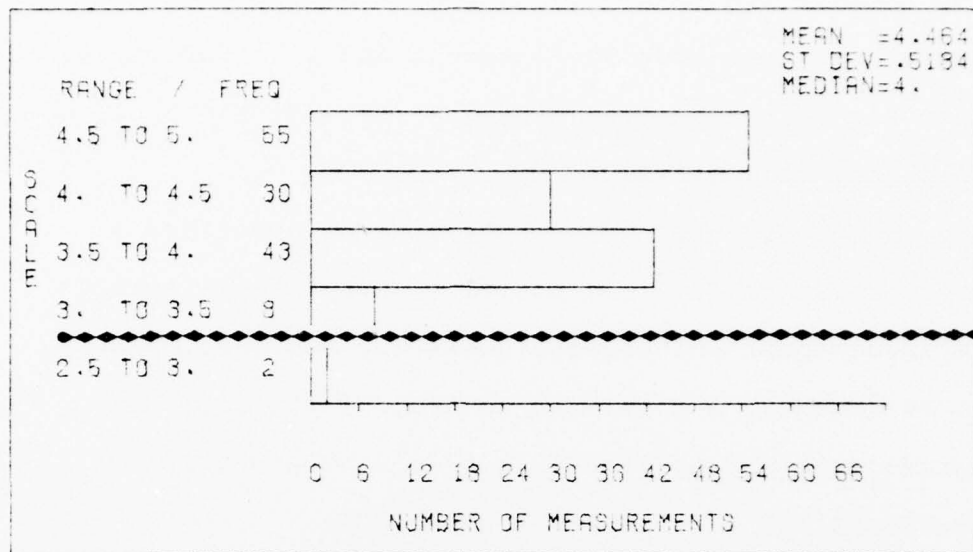


Figure 15. Histogram of the Effectiveness Index

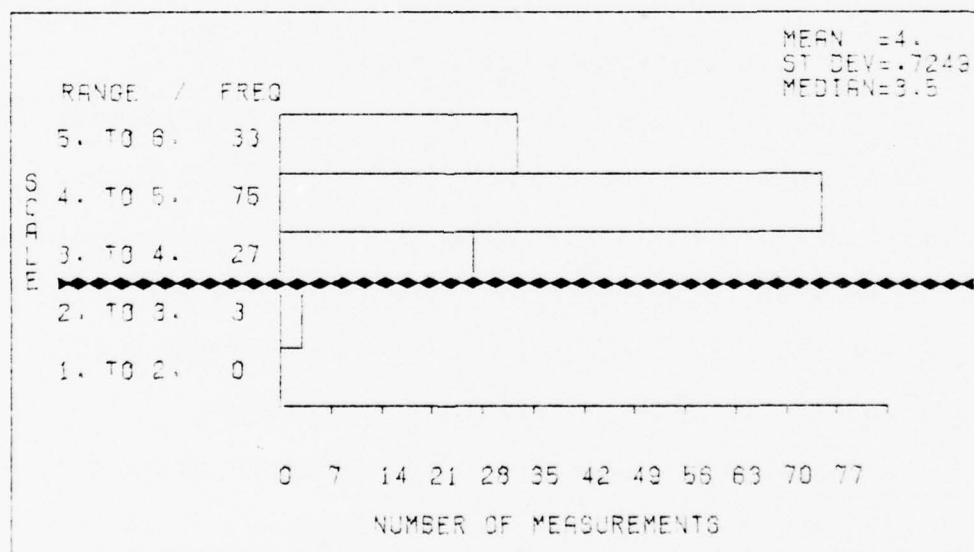


Figure 16. Histogram of the Efficiency Index

seen by the fact that 98.6 percent and 97.8 percent of responses were above the midpoint for effectiveness and efficiency respectively.

Because the research hypotheses specified a direct relation (i.e., a positive correlation) between RCM involvement and effectiveness and RCM involvement and efficiency, a right-tailed test of statistical significance was applied (27:283-4). The statistical hypothesis for this test was as follows:

$H_0: r \leq 0$  (i.e., a positive relationship does not exist)

$H_1: r > 0$  (i.e., a positive relationship does exist).

Where:  $r$  = the coefficient of correlation.

Table 11 shows the results of this statistical hypothesis test for the correlation between the factor index scores and the effectiveness and efficiency indices. As can be seen, only Factor 5 exhibited a statistically significant positive correlation (90 percent level of confidence) with effectiveness and efficiency.

Since these correlation coefficients of Factor 5 with effectiveness and efficiency, .2166 and .1513 respectively, did not approach +1.00, a strong association (linear relationship) of Factor 5 with effectiveness and



TABLE 11  
CORRELATION OF INVOLVEMENT FACTOR INDEX SCORES  
WITH EFFECTIVENESS AND EFFICIENCY

Factor	Effectiveness		Efficiency	
	Correlation Coefficient	Percent Confidence	Correlation Coefficient	Percent Confidence
1	-.0605	26.4	-.1564	5.1
2	.0517	70.5	-.0155	43.6
3	-.1034	14.0	-.1733	3.4
4	-.0326	36.7	-.1369	7.6
5	.2166	98.9*	.1513	94.4*

\*Statistically significant at 90.0 percent confidence or greater.

efficiency could not be assumed (27:279). Because ". . .  $r^2$  is a more easily interpreted measure of association, [27:279]" it was computed to determine the strength of the relationship. ". . . Its usefulness derives from the fact that  $r^2$  is a measure of the portion of variance in one variable explained by the other [27:279]." Criteria for testing the strength of association indicated by  $r^2$  were as follows: An  $r^2$  between .8 and 1.0 indicates a strong linear relationship (association) between two variables; an  $r^2$  between .2 and .8 requires a subjective determination for establishing strength of an

association; and an  $r^2$  less than .2 indicates a poor association between two variables (20).

The  $r^2$  of Factor 5 with effectiveness and efficiency were computed to be .0469 and .0229 respectively. Since these values were less than .2, a poor association existed between Factor 5 and efficiency and effectiveness. Because of this poor association, there was insufficient evidence to conclude that a meaningful direct relationship existed between Factor 5 and effectiveness and efficiency.

As the result of the above statistical and criteria tests, the researchers concluded that squadron level involvement was neither directly related to the organization's efficiency nor effectiveness. This conclusion was further supported by Table 11 which shows the results of similar statistical hypothesis tests applied to a correlation between the average factor scores and the effectiveness and efficiency indices. As can be seen from Table 12, Factor 5 only exhibited a statistically significant positive correlation (90.0 percent level of confidence) with effectiveness. The  $r^2$  associated with the correlation coefficient, .0436, however, was below .2 and no meaningful direct relationship could be established.

TABLE 12  
CORRELATION OF AVERAGE FACTOR SCORES  
WITH EFFECTIVENESS AND EFFICIENCY

Factor	Effectiveness		Efficiency	
	Correlation Coefficient	Percent Confidence	Correlation Coefficient	Percent Confidence
1	-.0568	27.7	-.0568	3.9
2	.0498	69.8	-.1069	13.2
3	-.1097	12.6	-.1697	3.7
4	-.0123	44.9	-.1512	5.7
5	.2089	98.6*	.0852	81.3

\*Statistically significant at 90.0 percent confidence or greater.

## CHAPTER V

### SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The purpose of this research was to determine the extent of squadron level RCM involvement in the base RMS, and the relationship between squadron level RCM involvement in RMS and the squadron's efficiency and effectiveness. The research was conducted to answer one research question and to test two research hypotheses as they applied to the population (responsibility centers within SAC, AFLC and ATC).

Research Question. To what extent is the squadron level responsibility center manager involved in the base resource management systems?

#### Research Hypotheses.

1. Squadron level responsibility center manager involvement in resource management is directly related to squadron level effectiveness.
2. Squadron level responsibility center manager involvement in resource management is directly related to squadron level efficiency.

### Summary and Conclusions

Use of the factor analysis technique enabled the researchers not only to measure the degree of squadron level responsibility center manager involvement in the base RMS, but to identify that involvement into five dimensions. These dimensions were: RCM involvement in reviewing and monitoring resource consumption; RCM use of the Resource Advisor in the base RMS; RCM control of resources; RCM interface with the Commander and Financial Management Committees; and RCM interface with subordinate Cost Centers.

The degree of RCM involvement was somewhat different in each of these five dimensions. Although involvement in control of resources and in interface with the Commander and Financial Committees was lower than involvement in the other dimensions, there were no dimensions for which RCM involvement was extremely low. Similarly, squadron level RCMs indicated a high degree of organizational efficiency and effectiveness. However, when organizational efficiency and effectiveness as measured by the survey instrument were tested against involvement in the five dimensions, the direct relationship which had been hypothesized failed to occur. This outcome suggested an organization's efficiency and effectiveness were unrelated to RMS involvement; that organization efficiency and effectiveness were caused by

something other than squadron level RCM involvement in the base resource management systems.

One key objective of RMS as identified in Chapter II is "To provide managers at all levels . . . with information that will help them assure that resources are obtained and used effectively and efficiently . . . [47:2-3]." To assure effectiveness (the organization's output quantity and quality) and efficiency (the relationship between inputs and outputs), requires the RMS be designed to provide information on both inputs and outputs. As was stated earlier, the framework for an Air Force output measuring system existed in AFM 178-4, Air Force Output Measurement/Management Indicator Systems, but there was not Air Force-wide implementation of the system, and in fact AFM 178-4 has now been rescinded.

If information on either inputs or outputs is not provided by RMS, then RCMs would be required to rely on some other source of information to assure efficiency and effectiveness. Since the necessary information on outputs is not being provided through RMS, RCMs may be relying on other sources of information to assure efficiency and effectiveness. The nature of those sources is a subject for further research.



Additionally, the relatively high degree of involvement in RMS by the squadron level RCM, as shown by this research, indicates that the system must be providing useful information for some aspect of management within the responsibility center. If the information provided by the RMS relates to inputs only, then that information may be useful to the manager in controlling the resources which are inputs to his processing. This aspect of managerial control was not investigated and provides a subject for future study.

#### Recommendations for Further Research

The general purpose of this research was to look at the basic resource management procedures at the local (base) level with the ultimate objective of helping the Air Force conserve resources. As was stated earlier, " . . . there is a continuing need to improve the quality and quantity of resource management throughout the Air Force [44:1]." With such a theme in mind, several specific areas for further RMS research surfaced during the course of this investigation.

Standardization of RC/CC Codes. MAJCOMS are given a certain degree of autonomy in the assignment of RC/CC codes by AFM 170-5, Responsibility Cost Center Codes. This autonomy has resulted in the inability to

pinpoint specific levels of responsibility, i.e., the squadron/division level RCM, without first going to the MAJCOM. Even then, it is difficult to find the exact responsibility level without consulting the MAJCOM RC/CC experts. Research is needed to determine if complete standardization of RC/CC codes would enhance the ability to identify and resolve resource management problems.

Review of Other Organizational Levels. Since squadron/division level involvement does not appear to be related to efficiency and effectiveness, research is needed to determine if other levels (the "processes" of Dr. Anthony's model, Figure 1) influence squadron/division efficiency and effectiveness. For example, as indicated by this research, the Wing Commander is perceived by squadron/division RCMs to have the most ability to control funds and his effect on squadron/division level efficiency and effectiveness needs to be determined. Similarly, research should be directed at the deputy commander, budget officer, and the cost center.

RMS Identification of Outputs. Research is needed to determine if RMS involvement allows resource managers to recognize organizational output, particularly in relation to resource inputs. The inability to measure output through involvement in the RMS

procedures may be the reason no relationship was found between RMS involvement and efficiency and effectiveness. This research has measured output in Dr. Anthony's terms of quantity and quality. It is possible that RCMs perceive output to be measured in more than these two dimensions, and research should be conducted to determine the extent of this perceived output measurement.

APPENDIX A  
RESPONSIBILITY CENTER MANAGER FUNCTIONS

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## RESPONSIBILITY CENTER MANAGER FUNCTIONS

Responsibilities	Measurement Question Number (see note)
<u>Financial Management Committee Responsibilities</u>	
RCMs should attend FWG and FMB meetings	14
RCMs should justify requirements at FWG and FMB Meetings	19
RCMs should recommend management actions to FWG and FMB	21
RCMs should explain expenditure variations from targets to the FMB and FWG	32
<u>Management Procedure Responsibilities</u>	
RAs develop expense targets for subordinate cost centers	13
RCMs and RAs review resource requirements and consumption by subordinate cost centers	29, 30
RCMs insure that RAs have a detailed knowledge of Operations and Maintenance costs	8
RAs review financial information on computer products	11, 6, 28, 38 16, 35, 36

NOTE: Measurement Question Numbers identify survey questions included in Appendix B.

APPENDIX B  
QUESTIONNAIRE



This appendix contains the cover letters for the original survey, the cover letters for the follow-up survey, and the survey instrument which was used for both the original and follow-up surveys.

DEPARTMENT OF THE AIR FORCE  
AIR FORCE INSTITUTE OF TECHNOLOGY (AU)  
WRIGHT-PATTERSON AIR FORCE BASE, OHIO 45433



REPLY TO  
ATTN OF: SLG (SLSR 3-77A/Maj Bradley/Capt McSwain/AUTOVON 78-72527)

SUBJECT: Base Level Resource Management Systems Questionnaire

20 Jan 77

TO: (ORIGINAL MAILING TO SAC AND AFLC STRATA)

1. The attached questionnaire was prepared by a research team at the Air Force Institute of Technology, Wright-Patterson AFB, Ohio. The purpose of the questionnaire is to determine the extent of squadron level responsibility center manager involvement in the resource management systems.
2. You are requested to provide an answer or comment for each question. Headquarters USAF Survey Control Number 77-34 has been assigned to this questionnaire. Your participation in this research is voluntary.
3. Your responses to the questions will be held confidential. Please remove this cover sheet before returning the completed questionnaire. Your cooperation in providing this data will be appreciated and will be very beneficial in evaluating the base level resource management systems. Please return the completed questionnaire in the attached envelope within one week after receipt.

*Henry W. Parlett*

HENRY W. PARLETT, Colonel, USAF  
Associate Dean for Graduate Education  
School of Systems and Logistics

2 Atch

1. Questionnaire
2. Return Envelope

DEPARTMENT OF THE AIR FORCE  
AIR FORCE INSTITUTE OF TECHNOLOGY (AU)  
WRIGHT-PATTERSON AIR FORCE BASE, OHIO 45433



REPLY TO  
ATTN OF: SLG (SLSR 3-77A/Maj Bradley/Capt McSwain/AUTOVON 78-72527)

SUBJECT: Base Level Resource Management Systems Questionnaire

4 Feb 77

TO: (ORIGINAL MAILING TO ATC STRATUM)

1. The attached questionnaire was prepared by a research team at the Air Force Institute of Technology, Wright-Patterson AFB, Ohio. The purpose of the questionnaire is to determine the extent of squadron level responsibility center manager involvement in the resource management systems.
2. You are requested to provide an answer or comment for each question. Headquarters USAF Survey Control Number 77-34 has been assigned to this questionnaire. Your participation in this research is voluntary.
3. Your responses to the questions will be held confidential. Please remove this cover sheet before returning the completed questionnaire. Your cooperation in providing this data will be appreciated and will be very beneficial in evaluating the base level resource management systems. Please return the completed questionnaire in the attached envelope within one week after receipt.

*Henry W. Parlett*

HENRY W. PARLETT, Colonel, USAF  
Associate Dean for Graduate Education  
School of Systems and Logistics

- 2 Atch
1. Questionnaire
  2. Return Envelope

DEPARTMENT OF THE AIR FORCE  
AIR FORCE INSTITUTE OF TECHNOLOGY (AU)  
WRIGHT-PATTERSON AIR FORCE BASE, OHIO 45433



REPLY TO  
ATTN OF: SLG (SLSR 3-77A/Maj Bradley/Capt McSwain/AUTOVON 78-72527)

25 Feb 77

SUBJECT: Base Level Resource Management Systems Questionnaire (Our Ltr 20 Jan 77)

TO: (FOLLOW-UP MAILING TO SAC AND AFLC STRATA)

1. This questionnaire is being sent as a follow-up to all positions for which responses were not received by 21 February 1977. If the response for your position has been returned, please disregard this letter. In addition to your questionnaire responses, the researchers are interested in the reasons why the first questionnaire was not returned. This information would be used in validating the questionnaire as a method of data collection.
2. You are requested to provide an answer or comment for each question. Headquarters USAF Survey Control Number 77-34 has been assigned to this questionnaire. Your participation in this research is voluntary.
3. Your responses to the questions will be held confidential. Please remove this cover sheet before returning the completed questionnaire. Your cooperation in providing this data will be appreciated and will be very beneficial in evaluating the base level resource management systems. Please return the completed questionnaire in the attached envelope within one week after receipt.

*Henry W. Parlett*  
HENRY W. PARLETT, Colonel, USAF  
Associate Dean for Graduate Education  
School of Systems and Logistics

- 2 Atch
1. Questionnaire
  2. Return Envelope

DEPARTMENT OF THE AIR FORCE  
AIR FORCE INSTITUTE OF TECHNOLOGY (AU)  
WRIGHT-PATTERSON AIR FORCE BASE, OHIO 45433



REPLY TO  
ATTNCF: SLG (SLSR 3-77A/Maj Bradley/Capt McSwain/AUTOVON 78-72527)

3 Mar 77

SUBJECT: Base Level Resource Management Systems Questionnaire (Our Ltr 4 Feb 77)

TQ: (FOLLOW-UP MAILING TO ATC STRATUM)

1. This questionnaire is being sent as a follow-up to all positions for which responses were not received by 28 February 1977. If the response for your position has been returned, please disregard this letter. In addition to your questionnaire responses, the researchers are interested in the reasons why the first questionnaire was not returned. This information would be used in validating the questionnaire as a method of data collection.
2. You are requested to provide an answer or comment for each question. Headquarters USAF Survey Control Number 77-34 has been assigned to this questionnaire. Your participation in this research is voluntary.
3. Your responses to the questions will be held confidential. Please remove this cover sheet before returning the completed questionnaire. Your cooperation in providing this data will be appreciated and will be very beneficial in evaluating the base level resource management systems. Please return the completed questionnaire in the attached envelope within one week after receipt.

*Henry W. Parlett*  
HENRY W. PARLETT, Colonel, USAF  
Associate Dean for Graduate Education  
School of Systems and Logistics

- 2 Atch
1. Questionnaire
  2. Return Envelope

BASE LEVEL RESOURCE MANAGEMENT  
SYSTEMS QUESTIONNAIRE

This survey is being administered to an Air Force-wide sample of responsibility center managers. We are not trying to describe your entire job--we are only interested in the resource management portion of your job. This survey should take no more than twenty minutes of your time.

Please complete the background information in Part I of the questionnaire. Your name is not required. The background information will be used to confirm that the survey reached the intended people. After completing the background information, please read the instructions for Part II of the survey and begin.

Please return the completed questionnaire within five workdays. Thank you for your cooperation.



### PRIVACY STATEMENT

In accordance with paragraph 30, AFR 12-35, the following information is provided as required by the Privacy Act of 1974:

a. Authority:

(1) 10 U.S.C. 8012, Secretary of the Air Force, Powers, Duties, Delegation by Compensation; and/or

(2) 5 U.S.C. 301, Departmental Regulations; and/or

(3) DOD Instruction 1100.13, 17 Apr 68, Surveys of Department of Defense Personnel; and/or

(4) AFR 30-23, 22 Sep 76, Air Force Personnel Survey Program.

b. Principal purposes. The survey is being conducted to collect information to be used in research aimed at illuminating and providing inputs to the solution of problems of interest to the Air Force and/or DOD.

c. Routine Uses. The survey data will be converted to information for use in research of management related problems. Results of the research, based on the data provided, will be included in written master's theses and may also be included in published articles, reports, or texts. Distribution of the results of the research, based on the survey data, whether in written form or presented orally, will be unlimited.

d. Participation in this survey is entirely voluntary.

e. No adverse action of any kind may be taken against any individual who elects not to participate in any or all of this survey.

PART I

Duty Title \_\_\_\_\_

DAFSC \_\_\_\_\_

Unit of Assignment \_\_\_\_\_

Base \_\_\_\_\_

MAJCOM \_\_\_\_\_

Amount of your annual O&M Budget \$ \_\_\_\_\_

Number of personnel assigned to your organization \_\_\_\_\_

How long have you been a responsibility center manager?

Here \_\_\_\_\_ (months)

Other units \_\_\_\_\_ (months)

Are you a member of the financial management board?

☐ Yes ☐ No

Are you a member of the financial working group?

☐ Yes ☐ No

Is your resource advisor a member of the financial working group?

☐ Yes ☐ No

PART II

*This part of the survey asks questions concerning organization's involvement in your base's management of resources. Each organization has different levels of involvement in resource management.*

*There are no right or wrong answers. Please be as objective as possible in responding to questions.*

- A. For Questions 1 through 6, indicate a response on each blank.

*Please rank the following individuals in order of their ability to control resources (i.e., place a 1 by the individual with the most control; a 2 by the individual with the second most control, etc.)*

1. ☐ Your subordinate Cost Center Manager
2. ☐ The Budget Officer
3. ☐ Wing Commander
4. ☐ You
5. ☐ Your Resource Advisor
6. ☐ Deputy Commander/Combat Support Group Commander

- B. For Questions 7 through 38, check only one answer per question.

7. What portion of your unit's resources do you actually manage  
☐ (1) A great portion  
☐ (2) A considerable portion  
☐ (3) A fair portion  
☐ (4) A small portion  
☐ (5) I do not manage resources at all
8. How much knowledge does your Resource Advisor have about the Operations & Maintenance costs incurred by your organization?  
☐ (1) Great knowledge  
☐ (2) Considerable knowledge  
☐ (3) Fair knowledge  
☐ (4) Little knowledge  
☐ (5) No knowledge
9. How much does your resource advisor support (assist and advise) you in reviewing and monitoring the over-all resource management program?  
☐ (1) Great support  
☐ (2) Considerable support  
☐ (3) Fair support  
☐ (4) Little support  
☐ (5) No support

10. Are your organization's requirements considered when your supervisor establishes his operating budget?

- ☐ (1) Almost all of the time
- ☐ (2) Very often
- ☐ (3) Half the time
- ☐ (4) Seldom
- ☐ (5) Almost never

11. How often do you examine your Responsibility Center and Cost Center "Balance Available" and "Due-Outs" for stock fund equipment and supplies?

- ☐ (1) Almost all of the time
- ☐ (2) Very often
- ☐ (3) Half the time
- ☐ (4) Seldom
- ☐ (5) Almost never

12. To what degree are your expenditures controlled by higher level financial administrators (people above you in the chain of command)?

- ☐ (1) A great degree
- ☐ (2) A considerable degree
- ☐ (3) A fair degree
- ☐ (4) A small degree
- ☐ (5) They do not control my expenditures

13. How involved is your Resource Advisor in developing expense targets?

- ☐ (1) Extremely involved
- ☐ (2) Very involved
- ☐ (3) Fairly involved
- ☐ (4) Not very involved
- ☐ (5) Not involved

14. Does your Commander or Financial Management Board Chairman encourage your attendance at FMB meetings?

- ☐ (1) Always
- ☐ (2) Usually
- ☐ (3) Sometimes
- ☐ (4) Infrequently
- ☐ (5) Never

15. To what degree can you substitute one resource for another to obtain an optimum mix of resources?
- ☐ (1) A great degree
  - ☐ (2) A considerable degree
  - ☐ (3) A fair degree
  - ☐ (4) A small degree
  - ☐ (5) Cannot make substitution
16. How frequently do you or someone designated by you monitor individual materiel transactions as recorded in the Daily Document Register?
- ☐ (1) Always
  - ☐ (2) Usually
  - ☐ (3) Sometimes
  - ☐ (4) Infrequently
  - ☐ (5) Never
17. What portion of your resource management decisions does your Resource Advisor make for you?
- ☐ (1) A great portion
  - ☐ (2) A considerable portion
  - ☐ (3) A fair portion
  - ☐ (4) A small portion
  - ☐ (5) Does not make resource decisions for me
18. When you generate savings are you allowed to use them for your own unfunded requirements?
- ☐ (1) Always
  - ☐ (2) Usually
  - ☐ (3) Sometimes
  - ☐ (4) Infrequently
  - ☐ (5) Never
19. Are you required to justify your organizational requirements before the Commander's review authorities (Financial Management Board, Financial Working Group, etc.)?
- ☐ (1) Always
  - ☐ (2) Usually
  - ☐ (3) Sometimes
  - ☐ (4) Infrequently
  - ☐ (5) Never

20. I determine the distribution of my approved operating budget.
- ☐ (1) Strongly agree
  - ☐ (2) Agree
  - ☐ (3) Undecided
  - ☐ (4) Disagree
  - ☐ (5) Strongly disagree
21. What portion of your financial management recommendations reach the Financial Working Group or Financial Management Board?
- ☐ (1) Almost all of them
  - ☐ (2) Most of them
  - ☐ (3) Half of them
  - ☐ (4) Very few of them
  - ☐ (5) None of them
22. Do you use the estimates of resource requirements and justification developed by your cost center managers?
- ☐ (1) Always
  - ☐ (2) Usually
  - ☐ (3) Sometimes
  - ☐ (4) Infrequently
  - ☐ (5) Never
23. What portion of the time does your supervisor ask for your advice concerning the affect of resource reductions?
- ☐ (1) Always
  - ☐ (2) Usually
  - ☐ (3) Sometimes
  - ☐ (4) Infrequently
  - ☐ (5) Never
24. Do the Financial Management Board and the Financial Working Group use inputs developed by cost center managers as the basis for resource realignments?
- ☐ (1) Always
  - ☐ (2) Usually
  - ☐ (3) Sometimes
  - ☐ (4) Infrequently
  - ☐ (5) Never



25. How valid are the resource requirements and justifications submitted by your Cost Center Managers?
- ☐ (1) Extremely valid
  - ☐ (2) Very valid
  - ☐ (3) Fairly valid
  - ☐ (4) Not very valid
  - ☐ (5) Not valid
26. When cutbacks in resources (men, time, material, money) are necessary, do you contact your Cost Center Manager for his assessment?
- ☐ (1) Always
  - ☐ (2) Usually
  - ☐ (3) Sometimes
  - ☐ (4) Infrequently
  - ☐ (5) Never
27. When cutbacks in resources (men, material, time, money) are necessary, are you contacted for your assessment?
- ☐ (1) Always
  - ☐ (2) Usually
  - ☐ (3) Sometimes
  - ☐ (4) Infrequently
  - ☐ (5) Never
28. Do you use the Responsibility Center Management Advisory Notice percentage parameters to help monitor your funds?
- ☐ (1) Always
  - ☐ (2) Usually
  - ☐ (3) Sometimes
  - ☐ (4) Infrequently
  - ☐ (5) Never
29. Do you review the resource requirements of your subordinate units?
- ☐ (1) Almost all of the time
  - ☐ (2) Very often
  - ☐ (3) Half of the time
  - ☐ (4) Seldom
  - ☐ (5) Almost never

30. How many of your subordinate cost centers do you review to determine if overages and shortages exist?

- ☐ (1) Almost all of them
- ☐ (2) Most of them
- ☐ (3) Half of them
- ☐ (4) Very Few
- ☐ (5) None

31. I am permitted to distribute targets for EEICs to my subordinate cost centers.

- ☐ (1) Strongly agree
- ☐ (2) Agree
- ☐ (3) Undecided
- ☐ (4) Disagree
- ☐ (5) Strongly disagree

32. Do you explain your variances from EEIC targets at Financial Working Group meetings?

- ☐ (1) Always
- ☐ (2) Usually
- ☐ (3) Sometimes
- ☐ (4) Infrequently
- ☐ (5) Never

33. Does your Resource Advisor work with Comptroller personnel when questions arise on matters pertaining to resource management?

- ☐ (1) Always
- ☐ (2) Usually
- ☐ (3) Sometimes
- ☐ (4) Infrequently
- ☐ (5) Never

34. I can reprogram my savings for my organization's use.

- ☐ (1) Strongly agree
- ☐ (2) Agree
- ☐ (3) Undecided
- ☐ (4) Disagree
- ☐ (5) Strongly disagree

35. Does your Resource Advisor monitor the day-to-day utilization of resources in your organization?

- ☐ (1) Always
- ☐ (2) Usually
- ☐ (3) Sometimes
- ☐ (4) Infrequently
- ☐ (5) Never

36. How often does your Resource Advisor brief you on the management report produced by the base-level accounting systems (the 1050-II and B-3500 computer printouts)?

- ☐ (1) Almost all of the time
- ☐ (2) Very often
- ☐ (3) Half of the time
- ☐ (4) Seldom
- ☐ (5) Almost never

37. How often does your commander review your financial program?

- ☐ (1) Always
- ☐ (2) Usually
- ☐ (3) Sometimes
- ☐ (4) Infrequently
- ☐ (5) Never

38. How frequently do you request the Responsibility Center Manager's Cost Center reports?

- ☐ (1) Always
- ☐ (2) Usually
- ☐ (3) Sometimes
- ☐ (4) Infrequently
- ☐ (5) Never

C. For questions 39 through 43, circle one answer per questions.

*Indicate by circling one number in each line the amount of control you feel you have (at your management level) over each type of expense. For example, if you can significantly control the amount of civilian pay expense incurred by your Responsibility Center, circle the 5; if you have little control over the amount of civilian pay, circle 1. If your Responsibility Center does not incur a particular expense, circle N/A.*

Degree of Controllability

	<u>Controllable</u>					<u>Not Controllable</u>
39. Civilian Pay	5	4	3	2	1	N/A
40. Supplies	5	4	3	2	1	N/A
41. Equipment	5	4	3	2	1	N/A
42. Travel & Transportation	5	4	3	2	1	N/A
43. Contractual Services	5	4	3	2	1	N/A

PART III

*Every organization produces something. It may be a product or a service. It is often hard to identify the product or service, especially in the Department of Defense. We would like you to think carefully of the things produced by your organization while responding to the next three questions. Check only one response per question.*

44. Thinking now of the various things produced by the people in your organization, how much are they producing?

- \_\_\_\_\_ (1) Their production is very high
- \_\_\_\_\_ (2) It is fairly high
- \_\_\_\_\_ (3) It is neither high nor low
- \_\_\_\_\_ (4) It is fairly low
- \_\_\_\_\_ (5) It is very low

45. How good would you say is the quality of the products of services produced by the people in your organization?

- \_\_\_\_\_ (1) Excellent quality
- \_\_\_\_\_ (2) Good quality
- \_\_\_\_\_ (3) Fair quality
- \_\_\_\_\_ (4) Not too good quality
- \_\_\_\_\_ (5) Poor quality

46. Do the people in your organization seem to get maximum output from the resources (money, people, equipment, etc.) they have available? That is, how efficiently do they do their work?

- \_\_\_\_\_ (1) Not efficiently at all
- \_\_\_\_\_ (2) Not too efficiently
- \_\_\_\_\_ (3) Fairly efficiently
- \_\_\_\_\_ (4) Very efficiently
- \_\_\_\_\_ (5) Extremely efficiently

APPENDIX C  
SURVEY ADMINISTRATION



This appendix contains schedules of receipt of questionnaire responses, a comparison of the invited and accepting samples, and a comparison of the useable sample to the population.

RECEIPT OF RESPONSES--ORIGINAL SURVEY

Week Response Received	<u>Questionnaires Mailed</u>		
	SAC	AFLC	ATC
	113	14	48*
	Number Received	Number Received	Number Received
1	19	3	-
2	46	7	-
3	10	1	5
4	7	-	22
5	-	-	1
6	-	-	1
Total Responses	82	11	29

RECEIPT OF RESPONSES--FOLLOW-UP SURVEY

Week Response Received	<u>Questionnaires Mailed</u>		
	SAC	AFLC	ATC
	31	3	19**
	Number Received	Number Received	Number Received
1	3	1	-
2	7	-	2
3	5	-	2
4	3	-	2
5	-	-	1
Total Responses	18	1	7

\*ATC questionnaires were mailed in week 2 of the Original survey.

\*\*ATC questionnaires were mailed in week 1 of the Follow-up survey.

# COMPARISON OF THE INVITED AND ACCEPTING SAMPLES

	SAC	AFLC	ATC
<u>Original Sample</u>			
Questionnaires Mailed	113	14	48
Responses Received	82	11	29
Follow-Ups Required	31	3	19
Response Rate--% of Total	73%	79%	60%
Unuseable Responses*	3	1	3
Useable Responses	79	10	26
Useable Rate--% of Total	70%	71%	54%

\*Unuseable responses in the Original Sample were attributed to the following:

a. Two questionnaires were completed by Resource Advisors within Deputy Commander for Operations and Deputy Commander for Resources areas of responsibility. The Deputy Commander Responsibility Center Level is above the Squadron Commander/Division Chief Responsibility Center Level which was the area of interest in this research.

b. Four questionnaires were completed by cost center managers subordinate to Squadron Commander/Division Chief Responsibility Center Managers. These Cost Centers are below the Responsibility Center Level which was of interest in this research.

c. One questionnaire was returned uncompleted.

COMPARISON OF THE INVITED AND ACCEPTING SAMPLES--Continued

	SAC	AFLC	ATC
<u>Follow-Up Sample</u>			
Questionnaires Mailed	31	3	19
Responses Received	<u>18</u>	<u>1</u>	<u>7</u>
Total Non-Respondents	13	2	12
Response Rate--% of Total	58%	33%	37%
Unuseable Responses**	2	1	-
Useable Responses	16	0	7
Useable Rate--% of Total	52%	-	37%
<u>Combined Samples</u>			
Questionnaires Mailed	113	14	48
Responses Received	<u>100</u>	<u>12</u>	<u>36</u>
Total Non-Respondents	13	2	12
Response Rate--% of Total	89%	86%	75%
Unuseable Responses	5	2	3
Useable Responses	95	10	33
Useable Rate--% of Total	84%	71%	69%

\*\*Unuseable responses in the Follow-up Sample were attributed to the following:

- a. Two questionnaires were returned uncompleted.
- b. One questionnaire was completed by a Resource Advisor at the Deputy Commander Responsibility Center level.

THE USEABLE SAMPLE COMPARED TO THE POPULATION

	SAC	AFLC	ATC
<u>Combined Sample Compared to Population</u>			
Population Total	486	59	206
Total Responses	100	12	36
Response Rate-- % of Population	21%	20%	17%
Useable Responses	95	10	33
Useable Rate-- % of Population	20%	17%	16%
<u>Stratum Compared to Population</u>			
Population Total	486	59	206
Stratum as % of Total Population (751)	65%	8%	27%
Useable Responses	95	10	33
Useable Responses as % of Total Responses (138)	69%	7%	24%

APPENDIX D  
CHI SQUARE TESTS



A Chi Square Test was conducted to determine if the original and follow-up samples were from the same statistical population. Once this test established that the two samples were from the same population, the data were combined and a second Chi Square test was conducted to determine if the questionnaire responses provided from each sample stratum were different. This appendix contains the results of both tests.

The Chi Square Test for  
Two Independent Samples

The Chi Square ( $\chi^2$ ) test for two independent samples was used to determine if the follow-up and original sample data were drawn from the same statistical population (20). The following statistical hypothesis was conducted for each question at the 90 percent confidence level:

$H_0$ : There is no dependence between question response and the sample (original or follow-up) which produced the response (i.e., the data in the two samples were produced by the same population).

$H_1$ : There is dependence between question response and the sample (original or follow-up) which produced the response (i.e., the data in the

two samples was produced by two separate populations).

This hypothesis test was resolved for each question by using a two by two  $\chi^2$  contingency table including the frequency of responses for each question from both the original and follow-up samples. A computer program was developed to compute the  $\chi^2$  test statistic for each question and the results are shown in this appendix.

The  $\chi^2$  critical value of 2.71 (90 percent confidence; degrees of freedom = 1) was compared to each test statistic value and the critical value was greater than the test statistic for each question. The null hypothesis ( $H_0$ ), therefore, could not be rejected, and the researchers concluded that the data was produced by the same population.

#### The Chi Square Test for Independent Strata

The Chi Square test for independent strata was used to determine if the questionnaire responses provided from each stratum were different (20). The following statistical hypothesis was conducted for each question and stratum at the 90 percent confidence level:

$H_0$ : There is no dependence between question response and the stratum (SAC, AFLC, or ATC) which produced the response (i.e., the responses provided by the different strata were similar).

$H_1$ : There is dependence between question response and the stratum (SAC, AFLC, or ATC) which produced the response (i.e., the responses provided by the different strata were not similar).

This hypothesis was tested for each question using a three by two  $\chi^2$  contingency table including the frequency of responses for each question from the SAC, AFLC and ATC strata. The  $\chi^2$  test statistic for each question is shown in this appendix.

The  $\chi^2$  critical value of 4.61 (90 percent confidence; degrees of freedom = 2) was compared to each test statistic for each question. The null hypothesis ( $H_0$ ), therefore, could not be rejected, and the researchers concluded that the responses provided by the different strata were similar.

TEST FOR DEPENDENCE BETWEEN QUESTION RESPONSES AND SAMPLE  
CHI SQUARE TEST STATISTIC BY QUESTION

Question Number	$\chi^2$	Question Number	$\chi^2$
1	.00	24	.03
2	.05	25	.00
3	.03	26	.36
4	.01	27	.00
5	.36	28	1.55
6	.16	29	.32
7	.21	30	.21
8	.38	31	.02
9	.00	32	.00
10	.49	33	.01
11	.43	34	.00
12	.05	35	.09
13	.08	36	.00
14	.33	37	.27
15	.03	38	.43
16	.09	39	.20
17	.98	40	.05
18	.12	41	.59
19	.01	42	.63
20	.00	43	.15
21	.07	44	.00
22	.05	45	.05
23	.00	46	.08

NOTE: Each test statistic is less than the  $\chi^2$  critical value of 2.71 (90 percent confidence; degrees of freedom = 1).

TEST FOR DEPENDENCE BETWEEN QUESTION RESPONSES AND  
STRATUM CHI SQUARE TEST STATISTIC BY QUESTION

Question Number	$\chi^2$	Question Number	$\chi^2$
1	.68	24	1.96
2	.65	25	1.19
3	3.73	26	.56
4	.86	27	.32
5	1.20	28	.40
6	2.91	29	.22
7	1.15	30	.39
8	2.64	31	.49
9	.02	32	.29
10	2.72	33	1.60
11	2.48	34	.25
12	2.85	35	1.37
13	3.03	36	3.22
14	2.40	37	.82
15	.04	38	3.35
16	2.10	39	1.02
17	1.66	40	1.12
18	.46	41	4.28
19	1.57	42	2.30
20	3.55	43	1.38
21	.90	44	.88
22	1.09	45	2.28
23	.22	46	2.35

NOTE: Each test statistic is less than the  $\chi^2$  critical value of 4.61 (90 percent confidence; degrees of freedom = 2).

APPENDIX E  
NOTES AND COMMENTS BY RESPONDENTS



This appendix includes the stated reasons for respondents not returning the original questionnaire as well as general comments and comments on specific questions which were extracted from the completed questionnaires.

Reasons For Not Responding To The  
Original Questionnaire Mailing

The cover letter used to forward follow-up questionnaires, requested respondents to indicate why they had not completed the first questionnaire. Not all respondents completing the follow-up questionnaire indicated why the first questionnaire was not returned. Those reasons received are listed below.

*Original not returned due to my hospitalization.*

*Was TDY and ill prior to this date concerning previous questionnaire.*

*Note; Your 1st questionnaire was not returned because I work 14 hours a day. I line up priorities at the beginning of each day and this always seemed to be at the bottom. Sorry.*

*I never received the first questionnaire.*

*Did not receive previous questionnaire.*

*1st questionnaire misplaced.*

*First questionnaire stated it was voluntary and because of other priority projects I decided not to take it.*

Follow-up letter dated 25 Feb 1977, respondent highlighted the following sentence: *Your participation in this research is voluntary.* And entered his own *!!!!* beside the sentence.

*Listed as voluntary and not really geared to a NAF operation.*

#### General Comments

Several respondents entered comments of a general nature on the questionnaires as indicated below.

*Would you believe a budget for FY77 was not submitted and no one can tell me what we are to be allocated? We work on a hand to mouth basis. This was in answer to amount of annual O&M budget.*

*Although I have tried to provide accurate responses I do not consider them an accurate or quantified answer as to what should and would happen if the organization I inherited had done its job properly.*

*As commander of a tactical flying squadron I have little control over financial resources. Equipment funds are provided based solely upon inbound personnel clothing requirements. Supply funds are allocated on a prorata share and have been adequate.*

*Units need a full time AFSC assigned to act as RA--if we are really to become cost effective.*

*Many of the questions in this survey are not applicable to my squadron! While my squadron expends an enormous amount of resources, much of it (flying hour cost) is not under my direct control.*

*This survey is worthless. Many questions about "resources" appear to mean O&M funds. Need to be specific.*

#### Comments on Specific Questions

The following list contains comments that were made on several questions. The stem of the question has been included for readability.

14. Does your Commander or Financial Management Board Chairman encourage your attendance at FMB meetings?

*Not welcome.*

18. When you generate saving are you allowed to use them for your own unfunded requirements?

*We never save. We always can use the small amount authorized or budgeted.*

25. How valid are the resource requirements and justification submitted by your Cost Center Managers?

*Very valid but nobody listens.*

26. When cutbacks in resources (men, time, material, money) are necessary, do you contact your Cost Center Manager for his assessment?

*Answered Always, and entered However no one cares. We continually do more with less. Actually this philosophy is counter productive.*

31. I am permitted to distribute targets for EEICs to my subordinate cost centers.

*Don't know what EEIC is.*

34. I can reprogram my savings for my organization's use.

*Reprogram for Wing use.*

38. How frequently do you request the Responsibility Center Manager's Cost Center reports?

*I automatically get what I need.*

*Have not had a chance to request this, yet.*

44. Thinking now of the various things produced by the people in your organization, how much are they producing?

*They are tremendously overworked!!*

*We've never had to fire the missile!*

45. How good would you say is the quality of the products of services produced by the people in your organization?

*Quality and production are very high if one considers the large number of untrained craftsmen (men direct from Lackland basic without tech school) that we work with.*

46. Do the people in your organization seem to get maximum output from the resources (money, people, equipment, etc.) they have available? That is, how efficiently do they do their work?

*With the tightness of resources we have no choice.*

APPENDIX F  
THE COMPUTATION OF FACTOR INDEX SCORES

The Factor Analysis Computer Program was used to construct factor scores for each respondent. These indexes were to be used in later analysis of squadron level RCM involvement in each factor as well as to test the research hypotheses concerning the relation of RCM involvement to organizational efficiency and effectiveness (27:487).

The computer program used to compute the factor scores included a term for each variable or question which was used in the factor analysis (27:488), and utilized the factor score coefficients provided in the terminal solution to compute each respondent's index value for Factors 1, 2, 3, 4, and 5. For example, each respondent's index value of Factor 2 ( $F_2$ ) was computed from the attached factor score coefficient matrix as follows:

$$F_2 = (.35764)Z_8 + (.30623)Z_9 + \dots + (-.04088)Z_{38}$$

Where: The coefficient in brackets came from the first column of the coefficient matrix and  $Z_n$  represents the standardized values of the variable  $Q_n$ .

These standardized variable values were computed by:

$$Z_n = (Q_n - \bar{Q}_n) / \sigma_{Q_n}$$



Where:  $Q_n$  = The respondent's answer to the given question.

$\bar{Q}_n$  = The mean of all respondent's answers to the given question.

$\sigma_{Q_n}$  = the standard deviation about the mean of all respondent's answers to the questions.

After these factor index values were computed for each case, they were stored on a computer file for later analysis.

FACTOR SCORE COEFFICIENTS

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Q08	-0.07019	0.35764	0.00746	-0.04128	-0.05187
Q09	0.03823	0.30623	0.04744	-0.02893	-0.03583
Q11	0.05837	-0.05098	0.01456	0.02985	0.01403
Q12	-0.01612	-0.01287	0.11143	-0.03157	-0.03124
Q13	-0.01470	0.22482	0.02378	-0.01661	-0.01270
Q14	0.03651	-0.01298	0.00261	0.16502	-0.05912
Q15	-0.03845	0.01382	0.06546	-0.08419	-0.08618
Q16	0.05278	0.01317	0.03639	-0.01516	-0.00347
Q17	0.03602	-0.11823	0.06795	0.00139	0.03214
Q18	-0.13781	-0.09238	0.58067	-0.03437	-0.00209
Q20	0.04099	-0.02324	0.18349	0.01040	-0.02077
Q22	0.03115	-0.04189	-0.04568	0.03599	0.19528
Q23	-0.00263	-0.04303	-0.02735	0.21255	0.04172
Q24	-0.09528	-0.03867	0.00446	0.00150	0.41955
Q25	0.01237	-0.03086	-0.00984	-0.11938	0.28063
Q26	0.02358	-0.00145	-0.08772	0.02234	0.15854
Q29	0.64533	-0.04527	-0.01321	-0.29578	0.04875
Q30	0.18592	-0.01645	-0.11381	0.13593	-0.11519
Q32	0.04992	0.00736	-0.01253	0.32493	-0.11003
Q34	0.03503	-0.07226	0.19460	-0.01219	-0.00663
Q35	-0.05454	0.23361	-0.05011	0.02113	-0.02044
Q37	-0.04360	-0.02991	-0.11660	0.35250	0.19725
Q38	0.19297	-0.04088	0.04208	0.05288	-0.04934

APPENDIX G  
THE COMPUTATION OF AVERAGE FACTOR SCORES

An SPSS computer program was used to compute average factor scores for each respondent by averaging the respondents' answers to the primary questions contained in each factor. The average was computed by summing each respondent's answers to the questions shown in each factor below and dividing by the number of question responses included in the factor. For example, if a respondent answered questions 11, 16, 29, 30 and 38 with values of 4, 3, 5, 4, and 4, respectively, the average factor score for Factor 1 would be as follows:

$$\frac{4 + 3 + 5 + 4 + 4}{5} = 4.0$$

		FACTORS				
		1	2	3	4	5
QUESTIONS*	Q11		Q8	Q12	Q14	Q22
	Q16		Q9	Q15	Q23	Q24
	Q29		Q13	Q18	Q32	Q25
	Q30		Q17	Q20	Q37	Q26
	Q38		Q35	Q34		

\*The questions included in each factor were those questions identified during application of the factor analysis technique as the major or primary contributors to each factor.

APPENDIX H  
RANKINGS OF MANAGERS' ABILITY TO  
CONTROL RESOURCES

Questions one through six asked respondents to rank the following individuals in order of their ability to control resources:

<u>Question</u>	<u>Individual</u>
Q1	The Subordinate Cost Center Manager (CCM)
Q2	The Base Budget Officer (BBO)
Q3	The Wing Commander (WG/CC)
Q4	The Respondent (RCM)
Q5	The Resource Advisor (RA)
Q6	Deputy Commander/Combat Support Group Commander (DC)

The Kendall Coefficient of Concordance (W) was selected as the best method to analyze the rankings. The technique provides the "solution to the problem of ascertaining the overall agreement among k sets of rankings [32:229]." Before the technique was employed, however, a decision was required on the treatment of missing values. Since questions one through six required each respondent to rank all six individuals, it was decided that any missing value would distort the data. As a result, if a respondent failed to answer one or more of the six questions, the case was deleted from this analysis.

The technique was then applied to the data in the following table:



Respondent	Question Response					
	CCM	BBO	WG/CC	RCM	RA	DC
1	6	2	1	5	4	3
2	4	2	1	3	6	5
.	.	.	.	.	.	.
.	.	.	.	.	.	.
.	.	.	.	.	.	.
122	6	3	1	4	5	2
$R_j$	545	426	282	424	484	400

Where:

$R_j$  = The sum of ranks assigned to each question.

The coefficient of concordance (W) was then computed by the following formula (32:231).

$$W = \frac{s}{1/12 k^2 (N^3 - N)}$$

where:

$$s = \sum (R_j - \frac{\sum R_j}{N})^2 = 38,936.83.$$

$k$  = The number of respondents = 122.

$N$  = The number of individuals ranked = 6.

$1/12 k^2 (N^3 - N)$  = The maximum  $s$  that would occur with perfect agreement among the respondents = 260,470.

After the coefficient of concordance,  $W = .1495$ , was computed for the data, the following statistical

hypothesis test was applied to this coefficient to determine if there was agreement in the rankings among the respondents.

$H_0$ : There is not agreement among the respondents' rankings.

$H_1$ : There is agreement among the respondents' rankings.

To test this hypothesis, the following Chi Square,  $\chi^2$ , test statistic was computed (32:236).

$$\chi^2 = k (n-1)W = 91.195$$

$$\text{Degrees of freedom} = N - 1 = 5$$

The  $\chi^2$  critical value of 90 percent confidence and 5 degrees of freedom was 9.24. Since the  $\chi^2$  test statistic was greater than the  $\chi^2$  critical value of 9.24, the null hypothesis,  $H_0$ , was rejected and the researchers concluded that the respondent rankings were in agreement.

After ascertaining that there was agreement among the sets of rankings, the next step was to develop the rankings. "The best estimate of the 'true' ranking of those entities . . . is provided by the order of the sum of ranks [32:238]." As a result the following overall rankings were established:

<u>Rank</u>	<u>Sum of Ranks (R<sub>j</sub>)</u>	<u>Individual</u>
1	282	Wing Commander
2	400	Deputy Commander
3	424	Responsibility Center Manager
4	426	Budget Officer
5	484	Resource Advisor
6	545	Subordinate Cost Center Managers

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